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A Platypus on a Uganda Sugar Estate

VOLUME 5, No. 9 SEPTEMBER 1953

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WORLD CROPS

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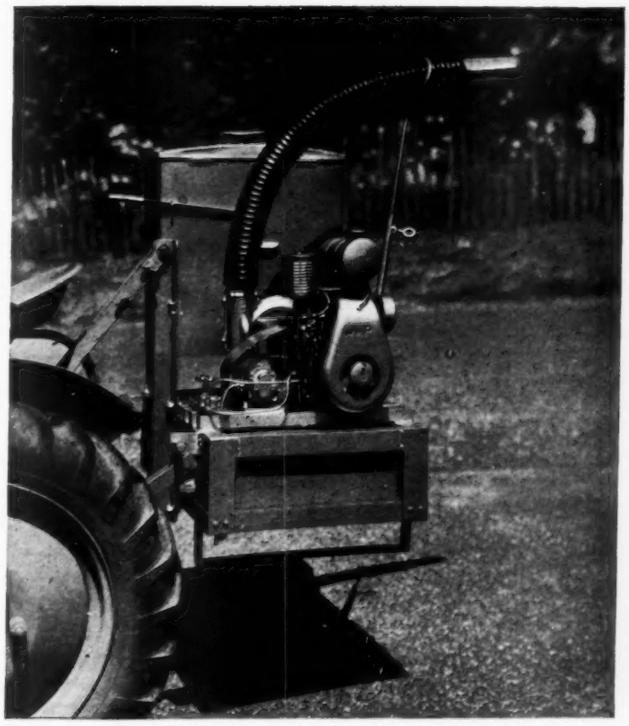

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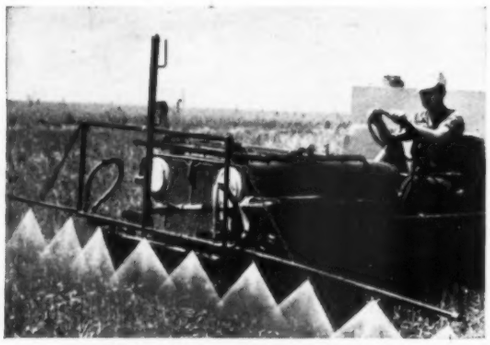

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Editorial Comment

Some anniversary celebrations

THE present year is notable for the fact that two well-known centres of agricultural research have been celebrating jubilees, golden in the case of one, Long Ashton Research Station, and silver in that of the other, Jealott's Hill Research Station. Both were events of some importance inasmuch as both institutions can claim to have made important contributions to agricultural research since their foundation.

Long Ashton

LONG ASHTON was founded in 1903 as the National Fruit and Cider Institute, largely as the result of a scheme for experiments on cider making started ten years earlier by Mr. R. Neville Glanville on his home farm at Butleigh Court, near Glastonbury. These were made the subject of a report to the then Board of Agriculture, which led in turn to the Board agreeing that the time had arrived when it was appropriate that the work should be extended by the formation of a fixed institute for research and instruction in fruit growing and cider making. This was a sufficiently epoch-making pronouncement in those far off days, when a suggestion of expenditure from the public purse on agricultural research seemed to many official minds to verge perilously near the blasphemous. With this was coupled the suggestion that such an institute would require an income of £1,100 per annum! The objects of the institute, briefly stated, included investigation of the best methods of cultivating and improving fruit and vegetables, investigation of methods of utilising fruit and vegetables, including the making of cider and perry, and disseminating the results of research which seemed likely to be practically useful.

The institute duly came into being, and in the intervening years it has expanded to its present imposing proportions; it has achieved a world-wide reputation and has to its credit a record of research and its practical application that has had a profound influence on agriculture. One need only mention the work of Prof. T. Wallace, F.R.S., on trace elements in plant nutrition, that of Dr. Hubert Martin, Mr. R. W. Marsh, Dr. H. G. Kerns and Dr. J. T. Martin on insect and fungoid pests of fruit trees and their control, of Drs. E. J. Hewitt and D. J. Nicholas on plant nutrition, or of Dr. L. C. Luckwill and T. Swarbrick on fruit culture and plant hormones to show how the work of the institution has expanded.

It is indeed a proud record that the institute can claim. To mark the occasion of the jubilee the University of Bristol, of which Long Ashton is an integral part, has published a volume by Prof. Wallace and Mr. Marsh under the title of 'Science and Fruit,' in which are recorded the main achievements of the station. The celebrations included a commemorative address by Lord Rothschild, chairman of the Agricultural Research Council, from whose concluding words we cannot do better than quote the following: 'In the case of Long Ashton no one can have any doubts that it is a happy and productive family. Fifty years may seem a long time in the existence of one man, but I hope and believe that it will be a very short one in the history of Long Ashton.'

Jealott's Hill

ON July 15 was celebrated the Silver Jubilee of the Agricultural Research Station founded in 1928 by Imperial Chemical Industries at Jealott's Hill. In the 25 years of its existence it has taken the leading place in Britain among the rapidly increasing list of experiment stations founded and worked by commercial organisations, its work has become known and recognised all over the world while its achievements are already worthy of mention in the same breath as those of older and universally acclaimed research institutions such as Rothamsted, East Malling or Long Ashton.

In our series, Industry's Contribution to Agricultural Research, we have already published an account of the activities of the station from the pen of its director, Dr. A. H. Lewis (WORLD CROPS, Vol. 4, p. 247), so that it is needless to recapitulate here, but we may recall that the station had its genesis as the result of the drive and vision of the late Sir Frederick Keble, F.R.S., formerly agricultural advisor to I.C.I., who laid down the original lines of investigation for the station and defined the principles on which a research station financed by a commercial company must work if it is to take its place alongside university and independent research centres. These are indeed worthy of being quoted here since they remain fundamentally as true as on the day they were spoken. Such a station he said 'must be the guide and not the servant of the company ; it must be free to publish all results, its quest must be knowledge not sales, its unswerving aim the long term prosperity of agriculture, irrespective of the immediate interests of the company, since in the long run both are identical. As a corollary, it must be free to embark on fundamental research showing no prospect of immediate gain.'

How far these principles have underlain the work of the institution is shown by the equipment and staffing of the station, as well as by the lengthy and impressive list of scientific papers which have emanated from it since its inauguration, and more particularly by the influence which its achievements have already exerted on practical farming in many lands. These to name but a few include the discovery of the hormone weed killers, the outstanding work on grassland management, including the use of fertilisers and grass drying, and the development of Benzene hexachloride as an insecticide.

Elsewhere in this issue we print a brief account of the celebration, but here we may say that if the station has already accomplished so much since its foundation twenty-five years ago, it seems reasonable to anticipate that still greater achievements await it in the future.

Mechanisation and yields

IT is commonly assumed that the main benefits of mechanised cultivation are savings in labour and time. But tractor ploughing can by itself lead to much bigger yields than hand-cultivation, a fact which has been vividly demonstrated in post-war African experiments at Genieri, a small Gambian village. These experiments are social and nutritional rather than agricultural, and it may well be that their cropping significance has escaped the attention merited. With native hand cultivation the highest yields of ground-nuts obtained were at the rate of about 220 lb. per acre. Mechanised ploughing led to yields of up to 1,100 lb. per acre. The difference cannot be credited to fertilisers for in this area compound fertilisers failed to give economic increases in yield, probably because trace-element deficiencies are more critical than supplies of the major plant-foods. The main influence affecting yields appears to be that of plant population, *i.e.* the number of plants per acre. With hand cultivation of the soil, only the top few inches are worked. An optimum plant population of a little over 10,000 per acre can be grown ; if a higher population is allowed to develop the total yield falls. But with deeper and mechanised ploughing, total yield does not fall with greater plant populations. It continues to increase even when more than 40,000 plants per acre are grown ; in fact, a little under four times as many plants per acre as the optimun number for hand-cultivated fields give not four times but over five times the hand-cultivated yield. Closer plant-spacing is possible because the roots can more quickly reach lower levels and lateral congestion is minimised ; probably, also, plant-foods in the lower soil are brought into operation. Usually the introduction of mechanised methods into native agriculture is associated with fertiliser usage as well, and higher yields are attributed mainly to the additional supply of plant nutrients. In this unique example, yield comparisons are uncomplicated by the latter variation. A fuller account of the work can be found in *Science News* (Penguin Books), Number 23.

Burma's rice crop

BEFORE the war three countries in Asia were the world's main contributors to the exportable supply of rice, *viz :* Burma, Thailand, and Indo China. The total amount of rice available for export from these three countries was for many years in the region of 4 million tons annually while in the years immediately befor the war it had shown a further tendency to rise sharply and exceeded 6 million tons in 1939. To this total Burma was by far the largest contributor, her available export surplus being in the region of from 2 to 3 million tons, the other two countries contributions ranging from 1 to 1½ million tons each. Since the war, the only country which has been able to maintain her export has been Thailand, in both Burma and Indo China available export supplies having greatly dwindled, mainly as a consequence of disturbed political conditions. Actually, average annual exports from Burma for the years 1948 to 1951 amounted to approximately 1,200,000 tons only while those from Indo China have averaged little more than 170,000 tons.

The effect of all this on the economy of the great importing countries in the East has been profound, *e.g.*, India, Malaya, Ceylon, Japan, Indonesia and Hong Kong, all of which with the exception of Japan formerly depended on these three countries for much of their supplies of rice. The shortfall has been met it is true to some extent by increased export production of rice in the Western Hemisphere, but difficulties in exchange have operated against full advantage being taken of this increase by the Eastern countries.

In consequence, the report that Burma expects a considerable increase in her production of rice as the result of this year's crop is very welcome news. It has in fact been stated that if the promise of the growing crop is fulfilled it is anticipated that Burmese exports this year may amount to 1,600,000 tons, equalling if not exceeding those from Thailand. The increase is mainly to be attributed to expanded cultivation which has come about as the result of the gradual suppression of Communism, Karen and other rebel groups, and of the lessening of dacoity or organised gang robbery, always a trouble in Burma and since the war a major menace. Moreover, this year steps are being taken to improve production through the use of fertilisers, better seed and cultivation in collaboration with advisors appointed under the Point 4 plan. In Burma, the sale of rice to other countries is a monopoly of the Government ; it is reported that this year sales are being made by the Government at prices round about $168 (U.S.A.) per metric ton, of which only about one fourth is received by the actual grower; the balance it is stated is being used by the Government for the benefit of the rice industry and the Burmese community generally. These prices are vastly higher than any which have previously prevailed for rice. It is to be hoped that the rice situation in the far East may show some amelioration as the result of the anticipated increased production in Burma, and that Burma itself may benefit to the full from the good prices she may expect from rice sales. It cannot however be overlooked that the continued rise in price of the staple food of this part of the world must continue to contribute to the inflationary spiral and so add to the dangers of a situation which is already sufficiently perilous.

Hot Springs and FAO

TEN years have elapsed since the world conference summoned by President Roosevelt to consider the problems of food supplies and agricultural needs of the post war world, met at Hot Springs, Virginia, on May 16, 1943. Memories are short but it seems not unlikely that this conference may go down to history as one of the most important ever held, since it was as a direct result of it that the Food and Agriculture Organisation of the United Nations came into existence.

At that time the war was raging in both hemispheres. Many people considered that the holding of such a conference at that particular juncture, when the ultimate outcome of the war still hung precariously in the balance, was to say the least somewhat premature. Others with wider vision perhaps, held that this particular first approach to post war problems was hardly the best or the most promising.

They favoured a more rigidly defined and restricted

overture, such as the general economic questions of supply and demand, or questions of exchange and currency.

However, President Roosevelt insisted on the approach he had proposed and his view carried the day. Who in the circumstances would deny that his view has not been abundantly justified by events? for ever since the major problem facing the world has been that of supplying the need for food and raw materials of an expanding population. One thing which that conference accomplished was to place in proper perspective the part which food supplies must play in the policies of the nations, and to accentuate that before all else the predominating preoccupation of Governments must be with enhancing and increasing the efficiency of agricultural production.

Since then FAO has come into being and after a preliminary period of hesitancy, has evolved a plan of working which has already achieved some notable results and promises more. Many of the problems have shown themselves to be more complex than the Hot Springs Conference realised. Indeed, it is now plain that the main obstacles stem not so much from the technical difficulties involved, but from the weaknesses and obstinacies of human nature and the prejudices and beliefs born of tradition, superstition, and ill founded political theory, sustained and aggravated by human combativeness, the annihilation of distance achieved by modern transport and communications, and the growth of human powers of destruction.

It is hoped that in the end these difficulties may yield to the pressure of collective common sense, when FAO and the national agencies with which it is allied will be free to implement and make effective the possibilities of better living which modern science and discovery is making available to mankind.

The FAO council

THE 17th session of the Council of FAO closed on June 24 last after having reviewed the progress made by the organisation in carrying out the programme approved by the last session of the conference in 1951. It transpired that world agricultural production is rising at a rate which just exceeds 2% annually, while world populations are expanding at the rate of 1.4% annually. This is on the surface of things a source of tempered satisfaction, but it appears that the increase in production is very unevenly distributed among the different countries of the world. Thus in Far Eastern countries the average per capita production of food is still only between 80% to 85% of what it was pre-war while in one country, Pakistan, famine conditions prevail.

The shortage of rice is the most alarming of all the shortages with which the world is faced since it is the staple food of a large proportion of the peoples of these South East Asian lands, which constitute nearly half the population of the world and which are most exposed to the threat of famine. The council commended the work FAO is doing to deal with the rice shortage and urged that the highest priority should be given to projects likely to assist in achieving higher rice production.

The Council also completed the arrangements for the 7th session of the full conference of member governments of FAO which is due to meet in Rome on November 23, 1953. Among the subjects set down on the agenda for discussion at this meeting are the current world situation in food agriculture and the outlook, the reform of agrarian structures, the financing of agricultural development, and the combating of malnutrition. We may recall that originally the conference which is the plenary body of FAO used to meet annually, but by reason of the expense and effort involved in holding annual meetings it was decided at the 1951 session to substitute biennial meetings for annual ones.

Saline soil cropping

THE problems of saline soils are well known, but a recent article by Dr. C. P. Brown (*The Grower*, 1953, 40, 1,33) describes new ventures in Egypt that are reclaiming land considered 'unfit for man or beast' only a few years ago. At Mariout, 35 miles west of Alexandria, the abundant sub-soil waters contain about 2% of soluble salts, water that is undrinkable by European tastes and standards. The rainfall averages less than ¾ in. per year. Today, a variety of crops is being increasingly won from this arid soil, using the strongly saline water for irrigation: almonds, olives, peaches, ju-jubes, carobs, pecan, and large-scale fodder crops for livestock. One factor for success has been the choice of suitable varieties. Attempts to establish the olive failed until a particularly drought-resistant variety, the Chimlali, was imported from Tunis. Another factor is the use of native plants as salt-absorbing crops, *e.g.*, the Australian saltbush, liquorice, and mesembryanthemum. The last-named plant, thickly set out in cuttings, can usually clear excessive salinity in a single year. Irrigation with the local saline water does not appreciably increase the saline content of the land, and this surprising absence of expectable effect is attributed to the indigenous plants that take up the salt selectively.

Salt-responsive or salt-tolerant crops must obviously be grown, and it is possible that by trial-and-error the Egyptian workers may have added to our knowledge of plant and salt relationships. Two of the most successful crops are soya and lima beans. A variety of clover well known in the Middle East, Bersem, thrives so vigorously that it can become a nuisance by excess! Sugar beet is, of course, successful, and beet tops with bersem provide abundant green fodder for animals. Among the green vegetables, it is interesting to learn that cabbage and cauliflower 'are easily the most successful, the yield comparing very favourably with that in the Nile Valley.' This is in line with the evidence obtained in modern American research and old experience in Britain that cabbages respond to salt dressings, a thesis that is seldom put into practice.

There is perhaps one advantage possessed by these saline and salt-water irrigated soils. They are highly calcareous and in the dry summer calcium sulphate surface incrustation commonly occurs. Since calcium sulphate is the best additive for offsetting the evil effects of grossly abundant sodium in flood-damaged soils, the presence of calcium sulphate in these Egyptian saline soils possibly brings a strong measure of self-correction.

A Canadian weakness?

THE biggest fall in Canada's chemical products in 1952 was scored by vegetable oils, whose output fell by as much as 11.9%. This is a fact to be measured against the general background of increase, for as a whole Canada's production of chemical and allied products rose by 3%. It is possible that the vigorous industrial expansion of Canada is reacting adversely upon her agriculture. Dr. J. C. Woodward of the Canadian Department of Agriculture recently urged farmers to increase oil seed crop acreages. Even now, with reduced vegetable oil production, Canadian farms supply the factories with only a third of the soya beans they process. In 1952, the soya bean acreage was only 172,000, and that of flax, the other established oil seed crop of the Dominion, was 1,206,500 acres. Rapeseed and sunflower cropping, though successful, have not been widely developed as yet. Rust disease is said to be restricting the present expansion of the sunflower acreage, but a new rust-resistant strain is expected to be available for 1954. The young mineral oil industry of Canada is expanding rapidly. The much older vegetable oil industry should not be simultaneously declining.

A mystery disease unveiled?

FOR some ten years American stock and dairy farmers have been troubled by a cattle disease of unknown origin. The very name given to it — X-Disease — has emphasised its mysterious nature. However, the symptoms are well defined—loss of appetite, salivation, and the eventual development of dry, hairless and thickened skin. The total national loss caused to the United States has certainly not been great, but on individual farms where the disease appears heavy losses of cattle may occur. At one time creósote was suspected of being a causative agent, a severe outbreak being associated with the use of this substance as a fence preservative. Research at three different centres, however, has shown that chlorinated naphthalenes are the cause of X-Disease. These are substances often used as additives in machinery greases. Farm mechanisation has steadily brought more greases into the fields and the yards, and cattle often develop the habit of licking the greased parts of tractors, harvesters, etc., thus ingesting di- or tri- or one of the poly-chlorinated naphthalenes, all of which have a fairly low toxic dose. Nor is this the only *modus operandi*. Machinery making cattle-foods, especially pelleting machines, may be generously treated with greases containing these additives. One outbreak of X-Disease was traced to the introduction of a pelleted lucerne cattle-food. Another outbreak seemed associated with the use of a concentrate. Any contamination of a foodstuff with grease containing a chlorinated naphthalene is a potential cause of X-Disease.

Action to prevent the use of these toxic substances in grease formulation is now being taken. Manufacturers have been asked not to incorporate them in greases likely to be used by farmers or cattle-food manufacturers. It is hoped that voluntary measures will quickly reduce the incidence of the disease. Unfortunately, other chlorinated substances—particularly insecticides like DDT and benzene hexachloride—have incurred suspicion though their chemical constitutions are much less similar than nomenclature suggests. Specific experiments have eliminated DDT as a cause of X-Disease ; in any case, the disease was known before DDT entered agriculture. However, the extremist school of thought that indicts all chemicals in general cheerfully ignores major differences between one chemical and another ; for them the word ' chlorinated ' is enough. *Chlorinated* naphthalenes cause X-Disease ; several of the modern and widely-used synthetic insecticides are *chlorinated* hydrocarbons. *Ergo*, DDT and the others cause X-Disease. Although arguments of this kind are so spurious, they are often colourfully expressed and readily believed by farmers unaware of the full facts.

The Society of Chemical Industry

THE annual general meeting of the Society of Chemical Industry recently concluded at Nottingham was remarkable, particularly for the fact that it marked the election for the first time in its history of an eminent agricultural scientist as its president for the ensuing year in the person of Sir William Ogg, Director of Rothamsted Experimental Station. This selection may be regarded as particularly appropriate at the present juncture, in as much as more than ever before is it becoming recognised that the survival of the human race depends in the last resort on the improvement and enhancement of agricultural production. Sir William, in addition to being universally recognised as one of the leading exponents of soil science, is also a specially appropriate choice inasmuch as he is also a farmer in his own right on his farm in Aberdeenshire.

He succeeds a long line of distinguished predecessors, who in the 72 years of the Society's existence have numbered men of eminence both in the academic side and also on the industrial side of applied chemistry. Sir William's immediate predecessor was Mr. Francis J. Curtis, president of the Monsanto Chemical Company. We take the opportunity of wishing Sir William a successful year of office.

The meeting itself was from the agricultural point of view notable for the paper read by Prof. R. L. Wain, in which he reviewed the work of himself and his colleagues at Wye College on the plant hormones and the extension of the principles involved to the development of systemic fungicides. Indeed, as one listened to Prof. Wain's fascinating exposition of his subject one wondered whether indeed one was not hearing of work which in the last resort might have a convergent bearing on the origin of life itself. It was also notable for the thoughtful address of the Society's medallist, Dr. L. A. Jordan, who posed the question whether science is not at present running some risk of becoming too severely utilitarian and materialistic in its outlook. The excursions arranged in connection with the meeting included visits to Messrs. Boots' experimental horticultural station at Lenton and to the Sutton Bonnington College of Agriculture, now a constituent part of Nottingham University, where in particular the work in progress on the water requirements of growing tomatoes aroused much interest.

Devising Systems of Permanent Agriculture in Southern Rhodesia

J. W. ROWLAND
Henderson Research Station

The evolution of suitable rotations which can form the basis of mixed farming systems suited to tropical and subtropical conditions is one of the major problems of agriculture in these parts of the world. In this article, the author describes some experimental work in progress in Southern Rhodesia directed to providing a solution suited to conditions in that country.

IN Southern Rhodesia efforts are being made to achieve a greater measure of self sufficiency in agricultural production and to stabilise and improve the fertility of the soils [7]. One of the most promising means of achieving this dual purpose is the development of alternate husbandry or ley farming whereby land is cropped for a period and thereafter used for forage production under perennial grasses and legumes. The failure of attempts to introduce this form of agriculture into the subtropics may be ascribed to many reasons, chief of which is the fact that that although much research has been done on the constituent parts of ley farming, the system as a whole has not been studied [1, 2, 4].

The past quarter of a century has been a period of research activity by specialists, and in the old world their work led to improvements in the old established and proven systems of farming. Among the native tribes in the subtropics of Southern Africa on the other hand there were no traditional forms of land use beyond shifting cultivation and migratory grazing and these were superseded in a haphazard fashion by modern large-scale grain and livestock enterprises, which have caused widespread loss of fertility. Following the European pattern, research rapidly showed the way towards bigger production from crop plants and increased yields from animals, but soil deterioration was not arrested.

Veld management

Pasture research which developed later also yielded piecemeal information on veld management and artificial pastures, but the practical use made of this knowledge was disappointing. Farmers found that the systems of veld management which had proved satisfactory in the experiments were difficult to use in practice and the artificial pastures seldom extended beyond the small propagation beds. It was perhaps inevitable that the early studies were made without adequate regard to their integration with crop and animal production and that selected artificial pasture grasses were sent out for use on farms without prior planning of their functions in the general scheme of forage production and use throughout the year.

It is now realised that the incorporation and correct use of leys and permanent pastures in current farming systems in the subtropics calls for a complete reorganisation of the farming pattern and this constitutes a problem of integration which neither farmers nor advisory services have as yet been able to solve. The arts of farming economically to high production levels and of continuously renewing fertility are unknown in these areas, and research in the integration of pastures, animals and crops with a view to the elaboration of prototype systems of permanent agriculture is an immediate need.

Research results

Work on these lines was started at Rietvlei near Pretoria in 1940 and was developed on the Henderson Research Station in 1951 [4, 5, 6]. It was found that a useful first step in integration is the study of various alternatives for achieving continuity of forage supplies at all seasons of the year. This forage, consisting of a varying combination of grazing, hay, silage and concentrates, needs to be forthcoming in an even flow month by month, with as little fluctuation in quality as possible. In the first instance also, it was found desirable to aim at maintaining quality in the bulk forage and to resort to the use of concentrates as little as possible.

Experimentally, this was necessary because concentrates tend to mask fluctuations in the quality of the bulk feed, and practically because of the high cost of concentrates, and the difficulty of producing concentrates as well as the cash crop quota in the rotation. The practice of using potential human foods for livestock feeding must decrease in the future.

Seasonal limitations

In the crop growing areas of Southern Rhodesia the bulk forage cycle has to be planned within the following general limitations. In December and January the natural veld provides good summer grazing

Cutting Napier fodder during fertiliser experiments

and thereafter it falls off in value. Veld hay can be made from this, but it is often of poor quality owing to coarse growth and heavy and persistent rains at haymaking time.

Through February, March and April, the veld becomes poor, and improvement of the quality of the grazing by grazing management or seed introduction have proved generally unsuccessful. Fertilisers can improve the quality of the herbage but they are expensive. If better quality herbage is desired it is necessary to plough and establish, either from seed or roots such grazing pasture herbage as Rhodes grass, Makarikari panicum or Star grass. These give good autumn herbage, as well as valuable hay. Annual crops such as pearl millet mixed with sunnhemp, or Sudan grass and velvet beans can be used at this time of the year as supplements. They can either be strip grazed or cut and fed green.

Through the months December to March, it is not difficult to maintain a good nutritional plane from grazing. Thereafter for a further month or so greater reliance has to be placed on the annual grass-legume forages for maintaining quality until the change over to winter feeding. In winter, protein shortage is an ever present threat to the wellbeing of the livestock, and heavy expense is incurred if purchased concentrates are relied upon at this time.

Silage

The main and the cheapest feedstuff should be high quality silage made from mixtures of perennial grasses and legumes, which can be ensiled through the rainy weather at their most nutritious stage of growth. Hay made in the dry autumn from late planted legumes, and midsummer grass hay are of great value in winter, although in wet seasons it is impossible to make midsummer hay in the open. Autumn grass hay is palatable but low in protein.

In the few farms with irrigation water, spray irrigated pastures have been shown to yield large quantities of high quality grazing or green fodder, which can greatly influence the nutritional plane. The use of fodder trees and fresh water fish as sources of protein also merits attention.

For the country as a whole, the most widely applicable methods of overcoming the protein deficiency in these months is by improving the quality of the silage by better ensiling techniques, by the incorporation of better legumes with the perennial grasses, and by some cheap way of ensuring the drying of midsummer cut perennial hays. Once yearlong forage sequences based on perennial grasses mixed with legumes have been worked out, and the value and cost of each appreciated, experiments can be made to find payable forms of livestock production that best fit the nutritional planes achieved.

Napier fodder being chopped at a trench silo

Integrated forage sequences

It is this putting together of a properly integrated sequence of bulk forages, based as far as possible on perennial grasses and legumes, and capable of furnishing a steady flow of feedstuffs throughout the year that forms the backbone of any plan of alternate husbandry [1].

It is obvious that the nutritional plane of the bulk feed should not fall below maintenance requirements at any time, but the gain both from the financial and the fertility aspects will lie in raising it far above maintenance. Work done on the Rietvlei Agricultural Research Station has shown that maintenance plus one gallon of milk throughout the year is not difficult and that maintenance plus two gallons of milk is by no means an idle dream [4].

Napier fodder and Teramnus uncinatus growing together

Experiments at Rietvlei

The experiments on Rietvlei comprised a series of 20 acre units in which different ratios of veld, planted pastures and legumes were used to provide yearlong bulk feed to milk cows. Continuity of bulk feed of unexpectedly high quality was achieved from the various combinations, and the carrying capacity was high when compared with that achieved on farms in the neighbourhood. An interesting field for further enquiry then opened up on the improvement of these forage sequences by the better use of legumes, and by better grazing, fertilising and livestock techniques.

Work of the type described above is a logical preliminary to the integration of the animal and ley phases with the cash cropping phase, to form a practical rotation. There are many alternatives from which to choose in planning the cropping run. For example, a decision has to be made on the grazing, cutting and fertiliser treatment in the last year of the ley prior to ploughing under, and a suitable crop has to be chosen to follow the grass. Little is known as to how long the cropping phase should last, and experiments are now in progress to

ascertain how best to utilise the dung and urine that the winter feeding of silage and hay produces.

Working along these lines of reasoning, a series of farm scale units is being developed on this station by a research team comprising pasture, crop and animal specialists. Different levels of fertiliser applications, different ley to annual crop ratios and different types of cattle are on trial. Suitable areas of veld or other permanent pastures are included in the arable land rotations. These units are supported by critical trials of cropping sequences, fertiliser use, grass legume mixtures, and animal feeding techniques.

The land on which this work is being done is a light red silty loam which is in a poor physical condition, puddles badly when wet and is very hard when dry.

At the present time this type of land is used for maize production following an ill defined rotation of maize and green manures. The green manure has a highly beneficial effect in the succeeding year's maize crop, and under a system of alternate maize and green manures, yields of 10 bags per acre can be expected from the maize crop, or 500 bags per 100 acres of arable. Contour banks check erosion losses.

An example

This extensive form of land use can obviously be improved and as an example, one of the experimental rotations now in progress is briefly tabulated below :—

9 YEAR ROTATION

9 Sections of 11 acres of arable land associated with 300 acres of veld for summer grazing and veld hay.

Treatment.	Year 51–52 Section	Year 52–53 Section	Year 53–54 Section
Treatment :			
1st year Napier-legume..	5	4	3
2nd year Napier-legume dunged in winter ..	6	5	4
3rd year Napier-legume dunged in winter ..	7	6	5
4th year Napier-legume ploughed in autumn ..	8	7	6
Potatoes or tobacco or legume	9	8	7
Maize 1	1	9	8
Maize 2 or wheat or Munga dunged in winter	2	1	9
Maize 1	3	2	1
Maize 2 or legume with Napier interplanted ..	4	3	2

In the initial stages, a sequence of maize and green manures and forages is employed until the ley rotation is in full operation. This applies in this instance to sections 1, 7, 8 and 9.

Areas of crops per cent.: 55% of maize and other crops ; 44% of grass/legume ley.

Fertiliser Treatments : On leys and maize :— 200 lb. per acre mixed phosphates and up to 250 lb. ammonium sulphate.

On potatoes :— 600 lb. potato fertiliser per acre.

Autumn grazing of Napier fodder and Makarikari Panicum

It has been found desirable in the creation of experimental units to lay down certain minimum target figures per 100 acres of arable land, in order to ensure adherence to the objectives of integration and balanced production. On the basis of previous work and local experience the target figures agreed upon by the research team for this unit are as follows :—

Maize 500 bags (or equivalent cash crop).

Legume hay 40 tons (12% crude protein on dry basis).

Napier silage 600 tons (10% crude protein on dry basis).

Napier late hay 40 tons (10% crude protein on dry basis).

Stover (maize) 60 tons.

Veld hay 100 tons.

A nutritional plane capable of furnishing maintenance plus at least one gallon of milk for milk cows is expected and sufficient grazing and forage for 150 mature cattle all the year round is to be produced. While it is not possible to forecast the value of animal products, it can be seen that with the achievement of a yearlong nutritional plane of the order of maintenance plus one gallon of milk, without concentrate supplement, the gross revenue from livestock can exceed that from the grain crop. The winter feeding of 60 tons of stover, 180 tons of veld and other hay and 600 tons of silage brings substantial amounts of manure into one third of the arable land each year, which is a heavy application. There is every reason on the basis of existing evidence for this target to be achieved. With the use of nitrogenous fertilisers, the yields of the leys can be quadrupled and this in turn implies a corresponding increase in the amount of dung and urine in circulation. With the development of these units it is found that current and relevant research findings are readily assimilated into the systems and that the units themselves present problems requiring further study.

Conclusion

A country's agriculture should not only produce enough from the land to give security to the people and a livelihood to the farmers, but also contrive an adequate renewal of the resources of soil, fertility and water from which the production comes. The development of ley farming is one way by which production can be increased and fertility renewed, and with the necessary facilities, research teams can approach these inter-relationships systematically. Integration studies supported by critical experiments can bring together the

(*Continued on page* 362)

Workers on a Southern Rhodesian farm chopping Napier fodder in the field

Robusta Coffee

A. E. HAARER, F.L.S.

THE fruit of the ' robusta ' coffee tree is more rounded than Arabian coffee, it holds less gelatinous juice between the outer skin and the parchment covering to the seeds and it has slight furrows on each side marking the place where the carpels join, each containing a single seed. The seeds, or the coffee ' beans ' of commerce are themselves usually smaller than Arabian coffee and, though flattened on the inner sides, they are rounder on their outer sides. In colour the beans are not such a bluish-green, possibly because of atmospheric influences where this coffee flourishes, and the brownish silver-skin adheres more closely.

Nomenclature

Not long ago, and in spite of a lifelong experience of coffee, the writer was very properly corrected when he classified robusta coffee as ' hard.'[1] It is not a hard coffee, and that which is grown in East Africa, Java and most parts of the world is classed by the trade as a soft and a medium mild coffee. The practice which has grown up in East Africa of calling robusta coffee ' hard ' is wrong[2] and, as Mr. Schluter says, ' a disservice to the producers.'

The word ' robusta ' is a trade name for coffee beans of the kind derived from *Coffea canephora*, and although many planters refer to their trees as robusta coffee they, too, are wrong and are propagating an error which is so widespread as to have become common usage. Some years after *C. canephora* had been found and described, Linden figured it as *C. robusta* (Linden) in his trade catalogue of ' New Plants of Horticultural Interest in the Colonies,' which he published in 1900. The Dutch, who planted the species extensively in the East Indies because it was resistant to leaf rust disease, also called it *C. robusta*, thus bringing the error into commerce until planters and trade throughout the world began to use this name.

Origin

In 1895, the species was found by Emile Laurent growing wild in the Congo basin and cultivated by Africans and Arabs. He identified it correctly as *C. canephora*, but two years later De Wildmann thought it was a new species and called it *C. Laurentii*. Meanwhile Linden had renamed it *C. robusta*. All three names referred to the same species found in that particular region, and since the species *canephora* had already been described elsewhere, *canephora* is correct and the only name accepted by botanists for the species as a whole.[3]

The term robusta is a trade name for coffee canephora; it is a soft and mild coffee and has a smaller bean than Arabian. The species is indigenous in Africa between 10 degrees north and south of the equator. The crop is grown extensively in the Bukoba district of Tanganyika, and in Uganda, both as a European and an African crop.

Coffee canephora (robusta) growing in Uganda. It shows the characteristic growth and the way the flowers are born in whorls, besides the corrugated form of leaf

The species is indigenous over a wide area of West Africa in association with equatorial forests. It is found in French, Belgian, Portuguese and British territories in West Africa, chiefly between the latitudes of 10 degrees North and 10 degrees South at altitudes from sea level up to about 4,000 ft., also as far east as Uganda and Southern Sudan and possibly in parts of Western Abyssinia. There are a great many forms which might be called varieties, and these have often been given specific names by botanists too eager to find new species or insufficiently aware of how the forms merge into each other through all manner of gradations. *Coffea canephora* is self-sterile and because it must have pollen from another tree before it will set seed, and since it readily crosses with *C. arabica*, *C. liberica* and many other true species of coffee found wild or cultivated in the same regions, it is not surprising that intermediate hybrids have appeared in such an array that the botanical classification is fast becoming confused.

Cultivated forms

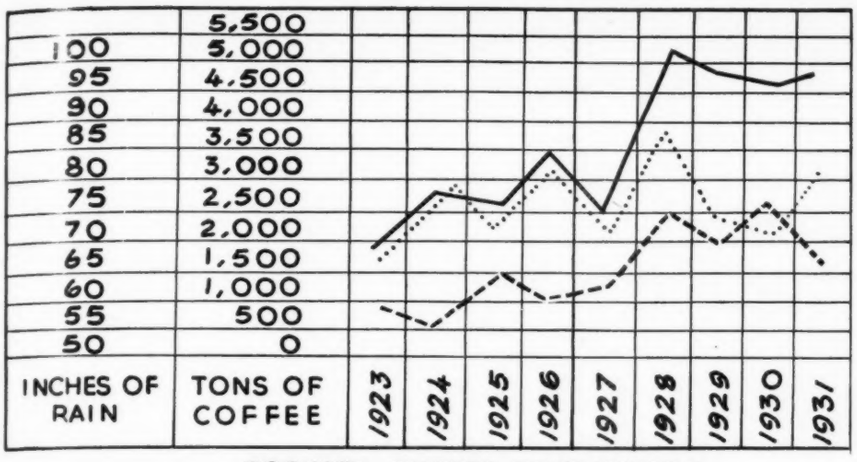
In Bukoba, North-West Tanganyika Territory, for instance, the Africans have cultivated *C. canephora* and *C. arabica* in close proximity for many years, and a most interesting collection of forms and hybrids exists today of which *C. bukobensis* is merely a form of, and synonymous with, *C. canephora*. It is doubtful whether *C. congensis* is a true species, for it may well be a dwarf form of *canephora*.

There are large and small leaved types, the leaves tough and leathery or paper thin, their edges waved or not as the case might be and their surfaces corrugated or flat. Growth is different too, so that some plants have an upright growth and make trees with thick trunks 30 to 40 ft. tall. Others bend over, make sucker growths and bend again until the plants assume the shape of large rhododendron bushes. The flowers vary in size as do the fruits and seeds, but there is one characteristic which is usual, for they are all tightly bunched together in separate clusters or whorls which surround each node of the flowering wood.

For purposes of commercial planting most of the intermediate forms may be disregarded. There are the so-called species and sub-species *C. Maclaudii*, *arabica* var *Stuhlmannii*, *Welwitschii*, *ugandae*, *kouilouensis*, *Hiernii*, *Hinaultii*, *muniensis*, *oligoneura*, *Trillesii*, *Wildemanii*, *opaca*, *sankuruensis*, *grisea*, *flavescens*, *latifolia* and possibly others, all of which one may consider are *Coffee canephora* of the two main types.

The two main types

The two main types are distinctive enough to be called varieties and there has grown a tendency to call one ' Kouilou ' and the other ' Nganda ' coffee. It remains to decide which is which! The kouilou coffee taken from the West Coast



This graph purports to show how rainfall affects production. The graph was kept during the author's residence in Bakoba District, Tanganyika Territory

of Africa to Java was said to be a tree bearing large elliptical leaves,[3] and the Javan types imported into Uganda mostly resemble the No. 9 selection, which is an erect and tree-like type selected from wild coffee found in the Toro Forest region of Uganda. Thomas, however, states that the 'Nganda' form, which has a spreading growth and smaller leaves, corresponds to the 'Kouilou' variety of the Dutch East Indies, and this would appear to be a contradiction.[4] So far as British production in Uganda is concerned the plantation grown upright type is generally the No. 9 and the spreading type now grown by the Africans is called 'Nganda.'

Selection and breeding

T. D. Maitland carried out some of the earlier selection work in Uganda; his No. 9 was considered the best and was distributed extensively to both European and native planters. Since the spreading type gave less trouble in pruning it was later decided to encourage the Africans to grow only the 'Nganda' type while the Europeans stuck to their No. 9.

In regard to genetics, a great deal more is known about *C. arabica*. Krug, C. A., and Carvalho, A., have stated[5] that problems in breeding *C. canephora* arise on account of self-sterility. The basic number of chromosomes is 11, *i.e.* 2n = 22, and all species show regularity in this respect except *C. arabica* which is polyploid. All the diploid species are self-sterile and only *C. arabica* is self-fertile. Fasciation in *canephora* is due, apparently, to one pair of recessive genes, whereas in *arabica* fasciation is due to incomplete dominance. By crossing two plants of *canephora* which are heterozygous for fasciation, segregation is in the proportion of three normal plants to one fasciated. A dwarf mutant occurs which segregates to the same proportion when similarly treated. The two genes controlling fasciation and dwarfness are independent, for when two individuals heterozygous for both characters are crossed a segregation of approximately 9:3:3:1 is obtained. Narrow leaved and other mutants have been observed.

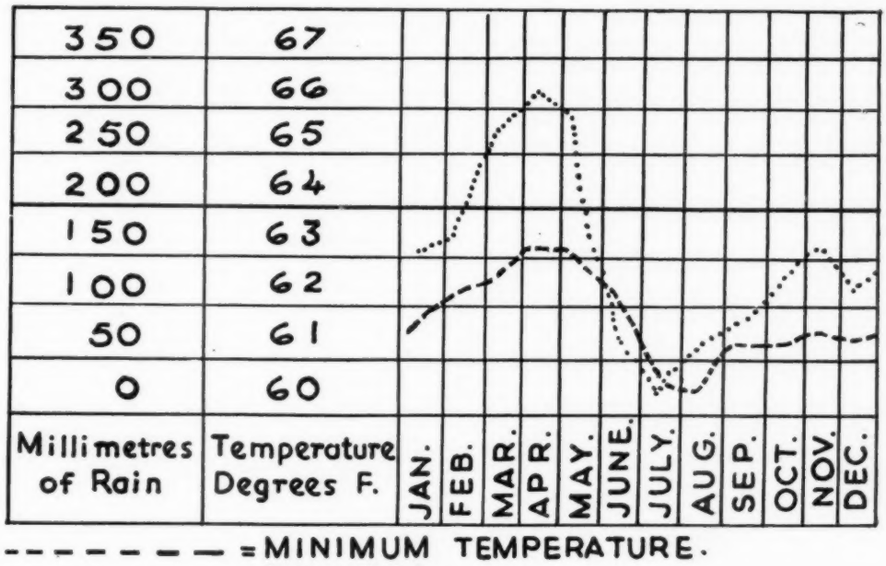
Location of plantings

Robusta coffee, to give it its trade name, was first grown elsewhere than in West Africa—in the Dutch East Indies, in Ceylon and in parts of India, when the leaf spot disease invaded the plantations of Arabian coffee. About this time Ceylon planters became interested in tea so that the robusta disease-resistant coffee was not taken up to any great extent in Ceylon. Later, in India, the Jackson's and Kent's varieties of Arabian coffee proved to be almost equally resistant to the disease so that Arabian coffee was not given up. One might therefore state that the present plantings of robusta coffee in Tanganyika and Uganda are some of the most important in the world since the annual production has grown to approximately 9,000 and 30,000 tons respectively.

Robusta coffee in Tanganyika

In the Bukoba district of Tanganyika Territory there is a narrow belt along the western shores of Lake Victoria where the rainfall averages about 75 in. per annum and, except for a short dry season, is evenly spread. In such close proximity to the lake the air is humid because the prevailing winds blow towards the shore. Temperatures are more equable than they are elsewhere, seldom rising above 80° F. and never falling much below 60° F. The near neutral to slightly acid soil is a friable loam overlying sandstone rock, and where the coffee is planted among bananas the soil has kept its fertility because of the heavy mulching practised by the inhabitants.

Under these circumstances robusta coffee grows luxuriantly and in such a trouble-free manner that one may excuse the ill treatment it receives at the hands of the local growers. It just does not seem to mind, although it is obvious to any visitor that better care would reap a much greater



This graph shows a mean of 19 years' records, Bukoba District

reward. The trees are planted in the smallest of holes, much too close to each other, and the banana shade does not give the uniform and controlled shade that is to be desired. The grower generally prunes his trees haphazardly with an axe or a chopping knife and leaves his wife to do most of the cultivation in a primitive fashion.

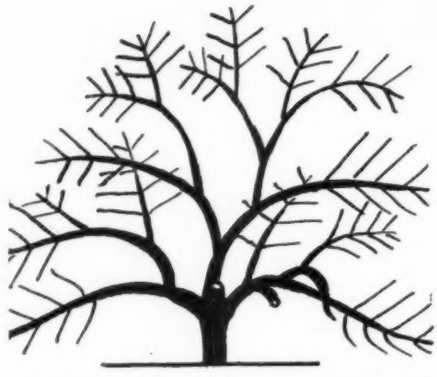
In spite of all this the coffee thrives. The writer has seen old trees that had fallen over on their sides, their branches rooting and growing suckers which in turn bent down and touched the soil until they rooted too, building up a single many-stemmed tree which grew 15 ft. high with a spread of 30 ft. In the poorer soil on the outskirts of the banana plantations or in full sunlight the trees grow poorly and bare of leaves except for tufts at the ends of the branches of a sickly and unhealthy colour. Yet there is no troublesome disease and beyond the bean borer beetle and thrips on exposed trees the pests appear to be in balance. The Stephanoderes beetle would give little trouble itself if more attention were given to plant sanitation.

The robusta bushes grow so large that much of the crop cannot be gathered until the fruits have ripened and dried. They must then be shaken down and gathered on mats laid beneath the trees. Unfortunately, many fruits remain on the trees beyond harvest time or they drop of their own accord between gatherings and give material in which the Stephanoderes beetle breeds and lies in wait for the next season. The fact that so little pulp is found in the robusta fruit favours the bean borer but does not encourage sucking bugs and the reverse happens with Arabian coffee.

Robusta coffee in Uganda

In Uganda, many a robusta coffee bush is grown without shade, and though a lack of shade will favour the presence of thrips or red spider and appear to hinder the healthy development of the topmost shoots and leaves, it does not seem indispensible in those areas where rainfall is sufficient and evenly spread and the air is not too dry. It is more important to shade the soil until the bushes spread sufficiently to give shade themselves, and wherever mulches of litter have been used a very noticeable improvement in the health of the trees has been achieved. Uganda is, of course, just over the border from the Bukoda district of Tanganyika, and the robusta coffee is at its best near the lake or on the wetter slopes of hills.

As the lower laterals of robusta trees become exhausted they die and drop off. It is not necessary to prune them away as it is with Arabian coffee which retains its

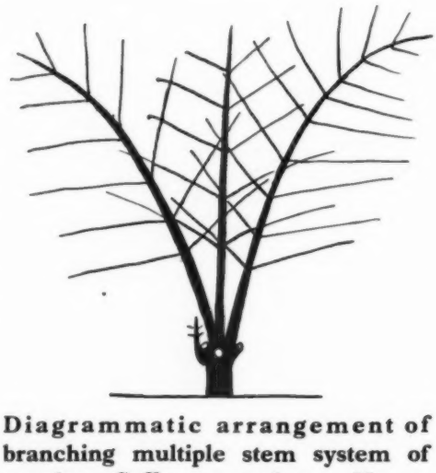


Diagrammatic arrangement of branching habit of Coffee canephora, Nganda variety

dead laterals for a long while, unless the dying wood is interfering with healthy growth. The Europeans in Uganda grow the upright No. 9 type of tree and it is necessary to train this to the multiple stem method of pruning otherwise the plants become tall trees with no laterals near the ground. With the 'Nganda' spreading type it is only necessary to assist the tree to make a bush by bending down the primary growth. Suckers are encouraged to break out earlier and then the thinning out of unwanted and spindly branches is all that is necessary.

Rainfall and soil requirements

A long experience of watching robusta and Arabian coffee growing side by side at varying altitudes in the same country leads to the opinion that robusta coffee requires a higher and more evenly spread rainfall than does Arabian coffee. It requires greater humidity and warmer temperatures but about the same kind of soil. This should be fertile, well-drained, near neutral but retentive of moisture. Though Arabian



Diagrammatic arrangement of branching multiple stem system of pruning Coffee canephora, No. 9 variety

coffee will grow best at cooler temperatures and will accept less rainfall it will survive and struggle against all sorts of adversities. On the other hand, robusta coffee will quickly succumb to conditions which are unfavourable and, indeed, the word robust somewhat belies its name though it is notable for its strong growth in a suitable environment.

Pulping and fermenting

Although robusta fruit has less juice which makes it difficult to pulp, the Europeans of Uganda persist in treating it this way and in fermenting, washing, drying and hulling the resulting parchment coffee. The bean is cleaner and brighter and fetches a slightly higher price than does the African robusta coffee which is hulled from the dried fruits. Nothing is gained during the fermentation and washing process but a cleaner and brighter bean, and African grown coffee would be of better quality if the fruit was all dried rapidly on staging instead of being placed, as it often is, on dirty matting on the ground.

Cultivation requirements

In a mature plantation of robusta coffee no cultivation should be done other than the eradication of noxious weeds because the feeding roots of the trees grow close to the surface and spread widely. Mulching is far more important; the writer also believes in light shade for robusta coffee using for the purpose a tree that will harmonise with coffee, such as a species of *Albizzia* or *Erythrina*, certainly not a *Grevillea* which appears to offer too great a competition for soil moisture and nutrients. So great is the effect of other crops and trees growing among coffee that one is tempted to believe that coffee may be susceptible to specific influences and not just from neighbouring plants, and that the effect is not alone due to being robbed of nutrient and moisture supplies. Both the main types of robusta coffee require to be planted at a greater distance apart than does Arabian coffee. Twelve feet square for the upright type and 15 ft. square for the spreading type is not too far apart to hole out the ground in the beginning, and the 'Nganda' variety may even require thinning out when the bushes grow full size.

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Cane Sugar in East Africa

A. C. BARNES, C.M.G.

East Africa is the newest recruit to sugar producing countries. The following account of conditions under which sugar is grown there is from the pen of Mr. Arthur Barnes, formerly Director of Research to the West Indian Sugar Association and a contributor to this journal. Mr. Barnes has recently visited the territory in question.

THE expression 'East Africa' connotes the Kenya Colony and Protectorate, Tanganyika Territory, and the Uganda Protectorate, comprising a total land area of 642,878 square miles, slightly more than four-fifths that of the Union of South Africa. The territories include Lake Victoria and the whole or portions of other lakes amounting in all to 38,901 square miles, of which Lake Victoria, situated at an elevation of 3,720 ft. above sea level, accounts for 26,828 square miles. The gross area is thus 681,629 square miles. Kenya and Tanganyika are bounded on the east by the Indian Ocean; Uganda lies in the interior with access to the sea through the other two. The climate ranges from tropical heat and humidity in the coastal and lake areas to cool and temperate conditions in the highlands, with extensive arid belts in the interior of Kenya and Tanganyika. The population of the three territories is estimated at 18,400,000 of all races. There are 59,000 Europeans and 259,000 Asians. The annual net rate of increase is estimated to be 1½% for the African population, 2% for the Asian, and 1 to 1½% for the European.

East Africa generally is in an active state of development, both agricultural and industrial. Within the memory of many persons the region has emerged from a state of primitive savagery to become the source of considerable quantities of varied commodities, including cotton and copper, sisal and sugar, coffee and tea, wheat and flour, pyrethrum and pineapples. Although electric power has been available in all the larger centres for many years, special mention should be made of the Owen Falls hydro-electric scheme which will make use of the enormous power of the lake water as it passes through a gorge nearly half a mile wide at Jinja and becomes the River Nile.

Mau Mau atrocities dominate Kenya news at the moment, but this subversive criminal pagan outbreak is localised, and though calling for stern suppression, directly affects but a small fraction of the population and total land area.

Historical

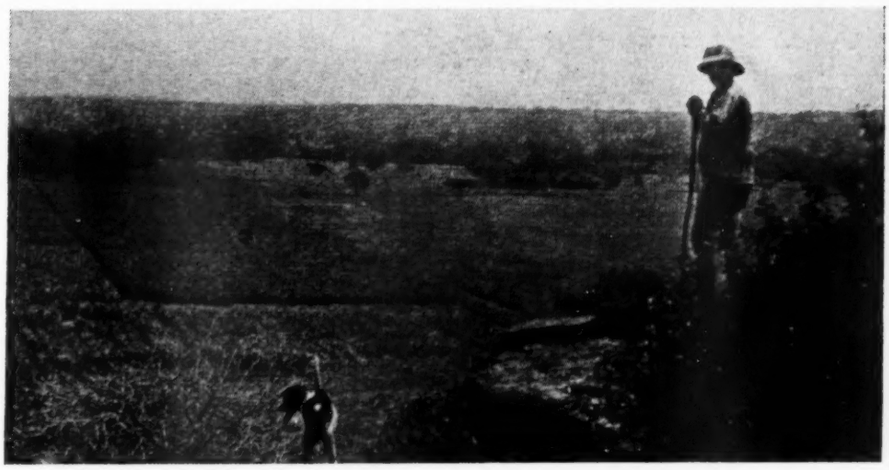
Sugar cane has long been a native crop grown on the edges of swamps or in moist ground, used for chewing and the preparation by crude methods of alcoholic drinks. The places selected by the Africans for cane have had much to do with the local fallacy that it is a swamp crop. Choice of land has really been dictated by the fact that cane can only survive if supplied with ample water during its period of growth, and most of East Africa experiences little or no rainfall for the greater part of the year. Because of this some of the earlier sugar ventures were established in unsuitable areas.

Cane sugar production by modern methods was commenced in 1924 at Miwani, near Kisumu in Kenya. Up to that time locally produced cane sugar was confined to 'jaggery,' made by direct concentration of the cane juice in open pans. A refinement of that simple method, copied from the West Indies in 1917, was the partial separation of impurities by defecation with lime and heat, followed by concentration to saturation by stages, using open pans. At the strike point the massecuite was ladled into wooden boxes and stirred with paddles until it crystallised. The sugar, which was golden yellow in colour, was afterwards dried in the sun. The product sold readily at £40 per long ton. This was the first serious attempt at organised cane growing and sugar manufacture.

The cane was grown under irrigation, water being brought by canal from the Athi River over a distance of 2 miles. The three-roller mill was water-driven, and it may be of interest to record that the earliest attempts at chemical control in East Africa were made in connection with this venture. This and other investigational work on sugar cane conducted at that time provided a basis for the later establishment of larger enterprises. Among the significant facts observed were the richness of the canes then grown and the high purities of the juices. Details are to be found in the Annual Reports of the Government Analyst and Director of Chemical Research, Nairobi, for 1917 and 1918.

Production and distribution

Today there are five estates with vacuum pan factories in operation—two in Kenya, one in Tanganyika, and two in Uganda. Jaggery continues to be made, particularly in Uganda, and in western Kenya, near to the Kavirondo Gulf, where more than 40 units were working in August 1952. In one district alone 2,000 acres of cane are solely used for jaggery production, the yield being reported as 200 lb. per long ton of cane, and sold at 10s. per frasila (35 lb.).



Irrigated fields of sugar cane, Kiboko Flats, Kenya, 1917

The five factories produce direct consumption sugar by the sulphitation process. The Miwani organisation in Kenya, near Lake Victoria, is the only one which accepts cane from a considerable number of farmers, who in almost all cases own jaggery factories and sell their cane when it suits them. There is no regulation of farmers' production and deliveries, nor any control of the price paid for cane by the manufacturer. One company in Uganda purchases cane from adjoining estates engaged for the main part in other agricultural ventures. Prices and distribution of sugar are controlled by the Director of Produce Disposal, East Africa. The retail price is the same for all grades of vacuum pan sugar, locally produced and imported, and at present there is no regulation of quality. The price at the factory is based on the Ministry of Food price for direct consumption sugar, the profits allowed to main agents, wholesalers and retailers being controlled.

Details of annual production for the past six years are given in Table 1.

TABLE 1
PRODUCTION BY TERRITORIES IN LONG TONS COMMERCIAL SUGAR

	Kenya	*Tanganyika*	*Uganda*	*Total*
1946-47	4,845	6,565	46,185	57,595
1947-48	10,498	7,206	66,130	83,834
1948-49	11,050	5,593	53,012	69,665
1949-50	11,682	8,546	49,593	69,821
1950-51	13,196	7,585	52,576	73,357
1951-52	14,301	9,952	50,936	75,189

The companies operating the estates and factories are:

Kenya: Miwani Sugar Mills (Kenya) Ltd., Miwani, near Kisumu (Miwa). Kenya Sugar Ltd., Ramisi, via Mombasa (Keny).

Tanganyika: Tanganyika Planting Co. Ltd., Arusha Chini Estate, Moshi (Tang).

Uganda: Madhvaninagar Sugar Works Ltd., Karira, near Jinja (Madh). Uganda Sugar Factory Ltd., Lugazi, near Jinja (Ugan).

The abbreviations used in tables which follow are indicated after the name of each company.

TABLE 2
PRODUCTION BY FACTORIES IN LONG TONS, JULY 1 TO JUNE 31

	Miwa	*Keny*	*Tang*	*Madh*	*Ugan*
1946-47	1,423	3,422	6,565	32,615	13,570
1947-48	6,332	4,166	7,206	40,159	25,971
1948-49	5,384	5,666	5,593	30,535	22,477
1949-50	5,460	6,222	8,546	30,591	19,002
1950-51	8,248	4,948	7,585	33,987	18,589
1951-52	10,428	3,873	9,952	28,481	22,455

TABLE 3
LONG TONS, FOR ANNUAL PERIODS JULY 1 TO JUNE 31

	Kenya	*Tanganyika*	*Uganda*	*Zanzibar*	*Military, etc.*	*Total*
1949-50 ..	42,485	20,297	22,411	4,989	348	90,530
1950-51 ..	39,561	24,316	30,848	4,400	200	99,325
1951-52 ..	40,747	25,773	33,555	3,900	325	104,300

Miwani Sugar Mills (Kenya) Ltd. are the successors to the Victoria Nyanza Sugar Co. Ltd., the original company operating in Kenya, having purchased the estates and factory in June 1947.

Details of sugar consumption for the past three years are given in Table 3, which include the figures for Zanzibar, military requirements, and industry.

The difference between local production and consumption has been provided by importation through the British Ministry of Food, the annual quantities being:

1949-50	.. ..	26,665 tons
1950-51	.. ..	21,650 ,,
1951-52	.. ..	33,932 ,,

Consumption

The estimated consumption for the year ended December 31, 1953, was 109,030 tons. Excluding Zanzibar and military requirements, the consumption of sugar per person on the basis of the figures quoted was at the rate of only 13.2 lb. per annum. For Kenya alone, where the non-African population is greater than in Tanganyika or Uganda, it was 16 lb. per person. It is evident that demand exceeds supply, and that were more sugar available it would readily sell. During mid-1952 retail purchasers in many large centres, particularly Nairobi, could not obtain their full requirements, while much of the sugar that was on offer was of sub-standard quality and unfit for human consumption. This position continued for some weeks, and was another indication of the inability of the local industry to satisfy consumptive demand. In fairness to the East Africa producers it should be stated that the low quality sugar had been imported.

The need for expansion

A conservative estimate of the present annual shortfall between production and demand is 40,000 tons. This will undoubtedly increase year by year until by 1957 it will be more than twice as much, even if the existing producers expand their output from an annual average total of 71,590 tons to 100,000 tons.* The three companies in Kenya and Tanganyika have embarked on schemes for progressive increases in production which should reach a total of 25,000 tons a year in five or six years. Present indications are that annual output when that expansion has occurred may be expected to remain at an annual average of 100,000 to 110,000 tons for the five operating factories unless increased capacity is provided at those in Kenya and Tanganyika, where the companies concerned have reserves of land capable of providing more cane. Assuming that this took place, a further 25,000 tons a year might be produced by 1959-60, but annual demand would by that time reach or exceed 200,000 tons.

*Weight figures are in terms of long tons of 2,240 lb.

The first organised attempt at sugar manufacture, Kenya, 1917

Irrigated cane at Arusha Chini, Tanganyika, 1952

The inevitable conclusion is that East Africa needs an immediately effective development programme of sugar production to overtake the shortfall, keep pace with expanding demand, and make the region self-supporting in respect of sugar. An exportable surplus for the growing needs of the Eastern Belgian Congo, the Sudan, and other adjacent countries might be attained with advantage.

In addition to the present expansion projects, there is great need of new enterprises, one initially planned to produce 40,000 tons of sugar per annum, capable of future extension to double that capacity, and one or possibly two of the order of 20,000 tons output, similarly to be doubled. This may at first glance appear to be an optimistic interpretation of the position, but the evidence of careful enquiries and close observation in the course of an extensive tour of the region rather points to the probable inadequacy of a sugar development scheme even of that magnitude.

Outline of existing industry

Climate and soil are favourable to sugar cane grown under natural rainfall in parts of Uganda and Kenya near to Lake Victoria. The deposition of dew plays an important part in providing water for cane in these areas. The three projects within this zone now provide 80% of the total annual production of East Africa. At the coast some 40 miles south of Mombasa is the only other enterprise with satisfactory rainfall. Irrigation schemes are, however, being put in on the two Kenya estates for part of the cane lands. The one company in Tanganyika is operating in an area with an average annual rainfall of 16.73 in., and the cane lands are irrigated by a gravity supply.

Agricultural operations are highly mechanised on all estates. It should be noted that agricultural machinery and equipment, including tractors, implements and tools essential for their maintenance are imported free of customs duty from all countries. Imports from hard currency countries are controlled. Crop data and other information are given in Table 4.

The cane variety position is not generally satisfactory, and though attention has been given to the matter the selection and testing of new introductions are poorly organised and inadequate for the needs of the estates. A collection of 90 is maintained by the Kenya Department of Agriculture at Kisumu. Among them are seven members of the N:Co. series, including 310. The wide range of conditions in East Africa makes it impossible to centralise experimental investigation. Such work should therefore be undertaken on the estates' land in such a manner as to study the requirements of each area. The absence of an association of cane planters and sugar manufacturers is an undoubted drawback to co-ordinated investigations as well as to the resolution of industrial problems. The failure to form such a body appears not to be related to economic interests but to some unconnected conflict of views. Thus at any time it is possible to bring four out of the five companies into union, but the fifth, which may be one or the other of two, is consistently in opposition. The solution may be found in some form of legal sanction, as the industry is unquestionably of high importance in the general economy of the region.

Labour

The employment of labour in East Africa is controlled and regulated by law, the principles of the legislation being basically similar in each territory. Labour departments administer these laws as well as those concerning health, safety and welfare in factories. The establishment of industrial relations between employers and employees by the formation of staff associations and works committees is encouraged. Official annual reports are published in respect of labour administration.

The provision of housing by the employer is a legal obligation unless employees can return to their homes at night, and on

TABLE 4

Factory	*Altitude (Ft.)*	*Varieties*	*No. of Ratoons*	*Average Age at Reaping (Months)*		*Yield per Acre, 1951-52 (Long Tons)*		*Average Rainfall (In.)*	*Area Reaped 1951-52 (Acres[2])*
				Plants	*Ratoons*	*Cane*	*Sugar*		
Madh . .	3,800 to 4,000	P.O.J. 2725 B./3172 Misc. 2%	2	18-20	15-18	38	3.0[2]	45.00	9,853
Ugan . .	3,900	P.O.J. 2725 P.O.J. 2878 P.O.J. 2961 Co. 419	2	18	18	41	3.9[2]	55.30	5,826
Miwa . .	3,959 to 4,500	Co. 281 Co. 290 Co. 421	2	22 normal 14 swamp soils	20	25[3]	2.34[2]	49.55 to 54.79[1]	3,239 estate[4]
Keny . .	50	Co. 281 Co. 419[1] B./3172	3	14	13	20[3]	below 2[3]	57.35	—
Tang . .	2,300	P.O.J. 2878 Co. 421[1]	9 (max.)	18	14	plts. 45-50 rts. 25-30	3.9[2]	16.70	2,500

Notes: [1] Area being extended. [2] From official returns. [3] Approximate figures.
[4] Farmers supplied cane from 1,650 acres additional. Recorded figures apply to estate operations.

sugar estates labour camps provide accommodation for most, if not all, of the labour employed. The site, design, and construction of labour camps are subject to approval. The number of persons to the acre and to each room are regulated. Health and welfare services are compulsory, and rations must be supplied for unskilled labour in accordance with approved scales. The recruitment of labour is conducted by licensed recruiters who may operate only in particular districts which are specified from time to time.

Communications

Four of the five sugar enterprises are on or near to the railway. The other depends on road transport, though communication with other coastal areas by water could be developed. The Arusha Chini factory is connected with Kahe Junction by an E.A. standard gauge tramline 8 miles in length, over which the estate traffic is manually propelled. The road system of the territories is extensively used for heavy traffic. The East African Railways and Harbours is the controlling authority for rail and steamer services, as well as for bus services on certain main routes. There are projected railways of which that from Kampala to Kasese is under construction. Another important link is the proposed new line in Tanganyika, which will run from Korogwe south-west to join the Central Line. The route has not been finally determined, but if constructed the line will pass through a promising new area for a cane sugar project near Turiani. The possibility of a rail link with Rhodesia has been explored.

The success of cane sugar ventures depends upon ease and cheapness of communication and transport, as well as upon the climatic, agricultural, and technical requirements of successful cane production and sugar extraction. The locations suitable for new enterprises are limited by these considerations, and by the availability of sufficient areas of land within economic distance of satisfactory sites for factories. Though large-scale agricultural undertakings in East Africa are of modern origin, they have been established in most instances by private enterprise with no regional crop planning schemes. This has brought about a form of ribbon development along the lines of communication, especially the railways, in zones where soil and climate are suitable for particular crops. A striking example of this is sisal in the mid-Pangani valley of Tanganyika, where a chain of monocrop cultivations follows the track of the Tanga-Moshi railway line. Excellent conditions for large-scale sugar production under irrigation are presented in this area, but they are also highly suited to sisal, and it seems unlikely that there will be a change to sugar.

A typical labour ' camp '

Factors affecting new enterprises

There are, however, extensive runs of land where conditions are favourable to the success of new sugar enterprises, though with the exception of the north-eastern lake area irrigation would be desirable, and in some cases essential. Apart from the advantages of the lake climate, the availability of ample supplies of water of excellent quality is important. The average temperature of lake water calculated on the mean of figures obtained weekly at four depths ranges between 24.1° C. in August to 26.7° C. in March.

An important feature is that in all the developed and undeveloped cane areas, reaping and manufacturing operations can be conducted throughout the year. Factories can count on not less than 300 days' gross grinding time. It is only during the season of heavy rain that there is any serious interruption of operations, and this is of short duration. These factors exercise a highly favourable effect on the organisation of plantation work and factory economy. Staff and labour can be continuously employed on the same operations, with improved efficiency and the absence of seasonal peaks.

The governments of the East African territories have carried out extensive studies of climate, hydrology, and soils, the results of which are being used to make preliminary selections of land suitable for various forms of agricultural development, including sugar cane. Further intensive investigations are then made in relation to the conditions of the particular enterprise decided upon for each area.

New cane sugar ventures of economic size and output require heavy capital outlay, which is much greater than was needed prior to the last war. Despite this, the exceptionally favourable conditions in East Africa, which are here described, support the view that well-planned and properly conducted enterprises will prove successful and profitable.

(*The South African Sugar Technologists' Association.*)

Date Production in Pakistan

The warm days and cool nights of the summer season in the desert areas of Sind, the Punjab, Bahawalpur and Khairpur and Mekran States are suitable for the production of dates in Pakistan, which produces annually over 172 million lb. of dates, worth more than 30 million rupees.

To meet the overall food shortage in the world, particularly in the Asian countries, where production has failed to keep pace with the increasing population, it is essential to increase the output of food, to eliminate losses occurring in transport handling and storage, and to supplement the supply of food grains by a variety of fruits produced in appreciable quantities in Pakistan.

The Co-operation and Marketing Department, Government of Pakistan, has published a report embodying a detailed account of the supply and demand of dates in Pakistan. The report deals with home production and varieties, imports and exports of dates. It gives an account of preparation of dates for the market, which includes harvesting and packing, standardisation and grading. The report surveys assembling, distribution, markets and market prices, price spread, prices of dates on a wholesale and retail basis, market intelligence, storage, preservation and transport of dates. It concludes with recommendations for improving the date industry in Pakistan.

Forestry in Canada

JOHN GRINDROD, B.A. (Com.)

Forestry and forest products constitute one of the greatest industries of Canada, and wood, wood products and paper account for between one third and one half the country's total exports. Below is given a summary of the efforts now in progress to improve forestry in the Dominion and to set forest industry on a secure basis.

THAT there is now great need for improved methods of forest management is becoming increasingly recognised in Canada, not only by the governments, both federal and provincial, but by the forest industries and by the general public. This is being brought home by the fact that in recent years the drain on Canada's forests has been greater even than during the war period. In the war years depletion was 22% greater than pre-war, but latterly it has been 55% greater.

World use of wood is expanding rapidly. At a recent meeting of the Association of Forestry Engineers of the Province of Quebec Mr. V. E. Johnson, vice-president and general manager of the Canadian International Paper Co., said that the world increase of population was equivalent to a new city of 60,000 people appearing every 24 hours. At the turn of the century the average American consumed about 58 lb. of paper and paper board every year, while today he consumes 390 lb.

Forests, wood and wood products are vital to Canada. Forest products represent her No. 1 manufacturing industry and employ directly more than 200,000 people. Wood, wood products and paper constitute between one-third and one-half of the country's total exports.

Forest improvement

How, then, can Canada improve her forests, protect them against fire and disease and get a better public understanding of what the forests and their conservation mean? In posing this problem a very wide subject is opened up, but not one which is being altogether neglected. It is true that in Canada much needs to be done in growing more trees, in planning replanting programmes, in better harvesting and in the more successful protection of trees. In Danish coniferous forests, for example, 104 cu. ft. per acre are grown and 33 cu. ft. per acre in the United States, but the Canadian average is only 14 cu. ft. per acre, with up to 40 cu. ft. for the better stands.

Forest improvement and conservation are, in the main, long-term projects, but the foundations have already been laid for more efficient management both by federal, state and private owners.

Ownership of Canadian forests

About 93% of the Canadian forests are still publicly owned. Rights to cut timber are granted to commercial operators and to individuals, but the title to the land remains with the Crown. Provincial governments are responsible for the administration of forests lying within their own boundaries, while the Federal Government is responsible for the forests of the Yukon and North-West Territories. The Federal Government also undertakes research in forestry and the use of forest products and, under the 1949 Canada Forestry Act, is prepared to give assistance to the provinces in connection with certain activities. These include the protection, development or utilisation of forest resources, including protection from fires, insects and diseases, forest inventories, silvicultural research, watershed protection, reforestation, forestry publicity and education, construction of roads, improvement of streams in forest areas and improvement of growing conditions and management of forests for continuous production.

In May 1951, the Minister of Resources and Development announced that funds would be made available to assist provinces in completing their forest inventories and reforesting vacant Crown lands, and on the basis of this the individual provinces formulated plans for making inventories and for reforestation. Federal-provincial agreements were signed with seven provinces, whereby each of the latter undertook to complete an inventory of its forest resources within the next five years on a 50-50 cost basis. Four provinces signed agreements for assistance in reforestation. Under these the Federal Government will pay one-fifth of the cost of the establishment of new forest tree nurseries and one-fifth of the gross expenditure incurred in planting unoccupied Crown lands.

Air photography

In drawing up inventories air photography and field sampling play important roles. A special project, carried out in co-operation with the Anglo-Canadian Pulp and Paper Mills Ltd. on an area of 186 square miles in the Sault au Cochon region, Quebec, has served to develop and demonstrate forest inventory technique. Preliminary classification, based on air photographs, included such items as the average height of the stand, crown closure and forest type. Forestry tri-camera air

Logging operations on Vancouver Island, British Columbia

photographs were taken under winter conditions. These were used in conjunction with previously taken summer vertical air photographs. The former provided evidence of tree heights and for the determination of height and crown closure of the softwood portion of the stand. Subsequently a field party established and measured 230 fifth-acre sample plots, which were then compared with the air survey. This showed that the interpretation of the photos could be somewhat in error without serious detriment to timber estimates provided the bias was consistent.

Forest maps

For the use of field parties in the summer of 1951 provisional forest maps covering 3,000 square miles on the Mackenzie River in the North-West Territory and 150 square miles within seven Indian reserves in Ontario were prepared, while for 1952 similar maps covering 1,000 square miles on the Stewart River and vicinity in Yukon Territory and 1,150 square miles in the Avalon Peninsula, Newfoundland, were also prepared.

This kind of survey has been going on throughout the provinces, as well as identification experiments at Petawawa Forest Experiment Station and elsewhere to assist in interpreting photographs.

Provision of planting stock

Most provinces have also stepped up the production of planting stock since the war or are planning to do so. Ontario has now an annual output of 20,000,000 trees, 75% of which are supplied free to farmers, either to build up their woodlots, or to plant on non-agricultural land forming part of their farms. The recipients pay cost of transport only. The remainder are planted by the province on open or abandoned farm lands owned by the Crown or municipalities.

British Columbia produces 10,000,000 trees annually, 75% being planted by the province on Crown lands not restocking naturally. The remainder are distributed free to the forest industries for the same purpose.

Quebec produces 1,250,000 trees for planting on Crown or private lands. The three Prairie Provinces distribute most of their 500,000 trees annually to farmers for shelter belts. Nova Scotia and New Brunswick, with 250,000 trees, and Newfoundland, with 1,000,000 trees annually make up the remainder. In addition to the 33,000,000 trees grown annually by the provincial governments, a further 3,000,000 are produced by the forest industries.

On this reforestation farm trees are grown from selected seeds and cuttings. These men are loosening young trees with forks before pulling

Forest research

The Federal Government, several provincial governments, the Pulp and Paper Research Institute of Canada, the four universities with faculties of forestry and a number of the larger industrial companies conduct research into forestry and forest products.

With district offices in a number of provinces, the Forestry Branch of the Federal Department of Resources and Development undertakes research in silviculture, management, forest air surveys, forest fire protection and economics. In addition, the Division of Forest Biology of the Science Service, Federal Department of Agriculture, carries out investigations dealing with the biology and control of insects affecting forest and shade trees and forest products. Ten regional laboratories are maintained at strategic points across the country. Of the four branch laboratories of the Forest Pathology Unit, one, at Sault Ste. Marie, Ontario, was designed particularly for fundamental research on virus, fungus and bacterial diseases of insects. In some provinces, the Department of Lands and Forests take a prominent part in this work.

This worker on a reforestation farm in British Columbia is pulling trees which will be used to replenish depleted forest areas

Within the Forest Research Division of the Forestry Branch there are now 48 professional foresters engaged exclusively in silviculture and management research. A similar number are employed by various provinces and industrial organisations.

The present situation in Canadian forestry can be described as one of transition between the era of uncontrolled exploitation and one of planned forest management. Only now are the various economic, social and legislative forces producing conditions under which it is feasible to practise silviculture and the organisations are receiving more requests for information and assistance than they can handle.

Silvicultural practice in Canada

In the past, there has been little practice of silviculture in Canada and many questions cannot yet be answered in the light of experience, but those lines of approach are

charted which are most likely to be profitable.

To provide a foundation for silviculture, studies are in progress of the silvical characteristics of native species and the ecological relationships of the associations in which they occur. Forests are systematically classified according to productivity and development. Other subjects studied include genetics and tree breeding, the growth and yield potentials of different forest conditions, practical methods of determining growth and yield, improved methods of organising forest data, etc.

Objectives set by the Forestry Branch, which operates east of the Rockies, for the next five-year period are to review existing knowledge about the most important cover types, to develop a standard classification of forest sites, to develop practical methods of regenerating merchantable stands, to study successes and failures in respect of the regeneration of desirable forest species after logging or other disturbance, to study improved methods of measuring actual and potential growth and yield, the development of improved strains of native tree species, especially spruces, the development of improved forest regulation and the improvement of research methods.

As an example of the kind of work undertaken in this field may be mentioned the developments in the province of Ontario, where silvicultural research by the Forestry Branch is administered from Ottawa. Much of the work is done at the Petawawa Forest Experiment Station, some 120 miles north-west of Ottawa, in the centre of the area which formerly supplied large quantities of red and white pine lumber. At present special emphasis is placed on controlled experiments to determine the moisture, light, temperature and seedbed requirements of red pine, white pine and jack pine during germination and the first few years of development. In this work radio-active tracers are being used. Tree breeding is also done here, but material produced is sent to other areas for testing. This concerns, primarily, the development of improved strains of spruce, since this is now the most important tree species in many parts of Canada. Pine and poplar breeding experiments are now conducted chiefly by the Ontario Department of Lands and Forests.

In experiments for controlling bud worm, 1,000 acres of infested forest are sprayed daily from aircraft with a solution of DDT. This aerial view shows the spraying machine in action, with the aircraft about 80 ft. above the tree-tops

A Canadian Government entomologist and his helper inflating a balloon which will be used as a marker to direct aircraft in experimental spraying operations against bud worm

Pulpwood forests

In co-operation with the forest industries and the Department of Lands and Forests, the Forestry Branch is conducting an increasing amount of research in the pulpwood forests of the Boreal region of Ontario. This includes site classification and growth and yield surveys. The hard maple—yellow birch type—which is becoming increasingly important for veneers, sawlogs and pulpwood, is being studied in central Ontario and western Quebec.

At Petawawa several plans of forest management and silviculture have been prepared in co-operation with the companies and are now in operation.

Forest entomology and plant pathology

In recent years, there has been a rapid extension of staff and facilities for work in both forest entomology and forest pathology, a new Division of Forest Biology having been formed in January 1951, within the Science Service of the Department of Agriculture. This branch of forest control has been spotlighted recently as a result of the awakened interest in the danger from forest insects and disease and also as a result of the rather dramatic way in which these have been combated.

Work in this field includes research on forest insects and diseases in all their interrelationships, a nation-wide survey of these pests, methods of prevention or control and large-scale control operations in a technical or advisory capacity, in co-operation with provincial governments and industrial firms. Among the problems receiving intensive study are those centred on the spruce budworm, the European spruce sawfly, the forest tent caterpillar, dieback and deterioration of birch, the white pine blister rust and the decay relationships of various timber species.

Direct control action against these pests has, in the main, been of four kinds:

(1) The cutting and burning of bark-beetle infested trees.

(2) The application of chemicals (more recently DDT) to the skidways of logs left in the woods in consequence of an early spring break-up, to prevent borer damage in the stranded logs.

(3) Programmes of Ribes eradication to reduce the incidence of blister rust infections in white pine stands.

(4) The distribution of arsenical dusts

or DDT solutions from aircraft against defoliating insects, such as the hemlock looper in Ontario and British Columbia, the spruce budworm in various regions and the forest tent caterpillar in Ontario.

In the field of biological control parasites and, more recently, predators have been introduced to counteract pests of foreign origin and a number of these have become established, including species attacking the European spruce sawfly, the larch sawfly, the satin moth and the balsam woolly aphid, to mention a few.

Forest fire fighting

Among the many new developments in fire-fighting techniques may be recorded the adaptation of ' smoke-jumping ' (parachute) techniques to float-equipped aircraft in Saskatchewan, the use of helicopters on an experimental basis, the use of water-filled paper bags for ' bombing ' from the air in Ontario, advances in forest communications equipment and mechanical equipment, visible area mapping, training of fire crews, etc.

Training in forestry

Facilities for the professional training of foresters have expanded greatly in recent years and more men are taking up this work. At the four universities providing forest degree courses, undergraduate enrolment increased from 229 in the session 1944-45 to 900 in the session 1949-50. Up to 1951 some 1,700 foresters had graduated in all and about half of these obtained their degrees in the 1945-51 period. Other professional educational facilities are also being provided, such as postgraduate studies.

Educating the public has also been part of the post-war planning. This is especially important in connection with the prevention of fires. The press, radio, films and a wide section of business have all co-operated with Government departments in this. Some 350,000 copies of fire prevention booklets have been distributed to schools. In British Columbia the Canadian Forestry Association has a school forestry club numbering 60,000 pupils.

Conclusion

The foregoing represents a skeleton outline of what federal and provincial governments are doing to improve Canada's forests. Industry also is co-operating in this field. For instance, the Minnesota and Ontario Paper Co. has developed management plans for 52 units of forests, ranging from 500 to 60,000 acres in size, on a woodlot type of management that could increase growth rates to a point where each acre of timberland will yield a half cord an acre a year as compared with 0.15 cord an acre on unmanaged lands. Forest improvement is, in fact, one of Canada's main preoccupations for the future and much depends upon the successful development of the start already made.

Photos : High Commissioner for Canada

Pakistan Food and Agricultural Council

THE first session of the Pakistan Food and Agricultural Council was inaugurated in Karachi on July 2 by the Prime Minister, Mr. Mohammad Ali. He said that agriculture was and would continue to be the mainstay of Pakistan's economic well - being, mentioned the measures the Government had adopted to increase food production and referred to the Central Grow More Food Emergency Committee which scrutinised short term schemes for speedy results.

The Prime Minister stated that the main emphasis on development was centred on the following objectives:—

1. Ensuring adequate seed supply.
2. Providing facilities for obtaining insecticides and spraying equipment to Provinces for destroying insect pests and other plant diseases.
3. Taking effective steps to restore and maintain the natural fertility of the soil.
4. Extending the use of fertilisers and manures and bringing additional land under cultivation.

Irrigation schemes

He also mentioned the large irrigation and multi-purpose projects like the Ganges-Kabadak Scheme in East Bengal, the Lower Sind Barrage in Sind, the Thal and Taunsa Barrage Projects in the Punjab, and the Kurram-Garhi Scheme in the Frontier Province. He expressed the hope that with the implementation of these schemes, Pakistan would again become self-sufficient in food. These measures, he said, had to be supported by a sound, well-planned research programme. He mentioned that 13 such research programmes were already in operation.

Research schemes

Mr. Mohammad Ali emphasised the importance of research schemes in the field of animal husbandry, and stressed the importance of making scientific knowledge available to farmers. He mentioned the recommendations of the Agriculture Enquiry Committee to reorganise the extension services and create a streamlined organisation going right down to grass roots which would be responsible for the dissemination of scientific knowledge and information to cultivators and assist them in procuring quality seed and other requirements and in disposing of their produce at favourable terms.

Village development programme

He mentioned the Village Agricultural-Industrial Development Programme which the Government had undertaken in co-operation with the Technical Co-operation Administration and the Ford Foundation to train workers at village level for introducing improved agricultural practices in the villages and demonstrating in selected areas the possibility of increasing the efficiency of agricultural production and raising the living standards by the adoption of these improved practices.

The Prime Minister concluded by saying that his advice to all agricultural experts, technicians and field workers was to win the confidence of the farmers, because only then could they be persuaded to better their condition through increased production. He had no doubt that the Council would emphasise the fact that in the planning of its research programmes, the practical needs of the farmers were kept very much in the forefront, and that research information of a useful and practical nature was carried to the farmers in a manner intelligible to them, so that they might translate it into practice. In conclusion, he pointed out that agriculture was and would continue to be the mainstay of the country's economic well-being.

Devising Systems of Agriculture

(*Continued from page* 351)

required information in the shortest possible space of time. The losses of soil fertility and vegetation over the past 40 years have been great enough to warrant careful and thorough research on systems of husbandry as a whole. Already, the problem is yielding to organised research attack at those points where a start has been made.

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The Control of the Spruce Budworm

The spruce budworm is an insect which has a voracious appetite; chemical warfare helps to stop its ravages in the forests of Canada, where it is a serious pest.

THE spruce budworm (*Tortrix funiferana*) is a small caterpillar, less than an inch long. It poses, however, a tremendous problem for Canadian foresters since its food consists of young shoots of balsam fir and spruce. Periodic budworm outbreaks destroy new foliage on such trees over thousands of square miles, particularly in Quebec, Ontario and New Brunswick, and often continue for five years or more, until most of the trees are killed. Even those that survive are reduced in their growth.

That sets the stage for another outbreak in the future as the succeeding stand of timber invariably contains a high proportion of balsam fir. Some 250 million cords of timber have been destroyed since 1909—enough wood to make a band 4 ft. high, 60 ft. wide around the earth at the equator.

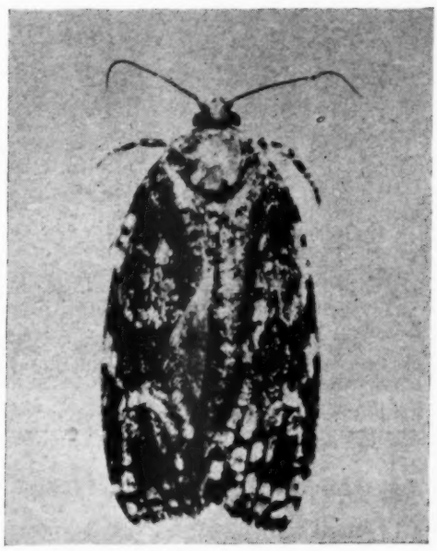
Canada's spruce-balsam forests also feed the growing and thriving pulp and paper industry. Besides threatening to literally eat the pulp and paper industry out of business, the budworm causes further potential damage since trees that die under attack are added forest fire hazards, while weakened trees are easy prey to disease.

The situation is being met with long-range methods of counter attack. These include improvements in cutting practices, study of parasites and diseases and scientific reforestation. Such methods of indirect or preventive control take time to develop. Meanwhile ' chemical warfare ' has taken over.

Fortunately, DDT has proved highly toxic to the budworm in the larval stages. More important, it can be applied economically in a concentrated oil solution to forests by means of aircraft spraying. This has been proved by experimental work, followed by commercial spraying operations in Oregon between 1949 and 1951.

Reports of the success of 1951 brought hope to northern New Brunswick which was undergoing budworm attack similar to one 30 years ago which destroyed 25 million cords of timber. An excellend pulpwood forest appeared doomed and the only hope of protecting lay in aerial spraying. The work was undertaken by the company which had leased the forest, and the Provincial authorities, the Division of Forest Biology, providing technical assistance and studying and interpreting the results.

The forest was larger and less accessible than any area previously sprayed, and presented several problems for rapid solution. The hilly terrain meant small planes were necessary to operate from an airfield within the area. The amount of flying had to be kept to a minimum. During the 1951-52 winter, a V-shaped airfield was bulldozed out of the forest and two 2,500-ft. airstrips surfaced. Tanks for insecticide and gasoline were installed with pumping systems to deliver measured quantities to six loading stations. A control tower was built. Nearby, a camp was constructed for 200 men, including a laboratory for spray assessment and biological studies. This became known as ' Budworm City.'



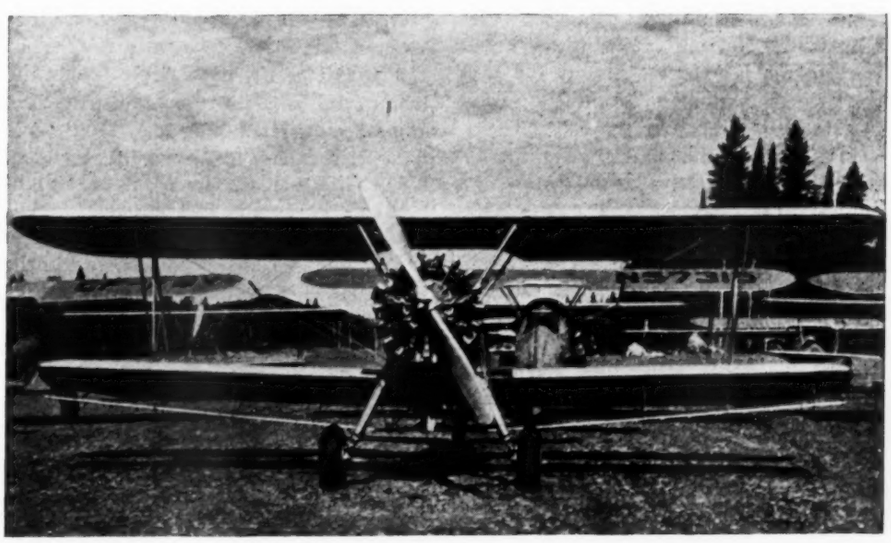
An adult spruce budworm moth

The Organic Chemicals Division of the Diamond Alkali Co. played one of the key roles in the campaign as their chemists at their Newark plant were faced with the problem of formulating a DDT preparation which would withstand low winter temperatures and meet all requirements for an aerial spray from the point of view of application and deposit. They succeeded in developing a product which held 1 lb. of DDT at sub zero temperatures and was satisfactory in all other respects.

Twenty-one planes, equipped with spraying tanks and apparatus, were ordered and the area to be sprayed was mapped into blocks and allotted to planes and pilots. Arrangements were made to check the effectiveness of the spraying operation with special paper impregnated with oil soluble dye strategically placed in the area.

Weather played a major role because spraying had to be done within a two-week period after the fourth larval stage was reached. Weather controls this development. To add to the complication, in its sixth and final larval stage the budworm eats three times as much as it does in all previous stages. The sooner spraying follows the fourth stage the better.

So spraying began on June 14, 1952, when 78% of the larvae reached the fourth



This plane, with spray booms fitted beneath the lower wings, was one of those used to spread spray at a rate of a gallon an acre, covering a swath 100 ft. wide

stage. Here, again, weather was a factor, for spraying could be done only when the wind above the trees was less than 8 m.p.h., with no upward air movement and no rain on trees. Two to four hours after dawn was the flying time limit except on calm, cloudy days. Weather stations at three fire lookout towers reported wind, temperature and visibility by radio every quarter-hour to Budworm City control tower.

No motion was lost when spraying began. Planes carried 125 gal. of insecticide, sprayed it at a rate of 20 gal. per hour, and spent an average of only four minutes on the ground between spraying trips for refilling and refuelling.

The paper 'sampling' showed remarkable coverage. More important, effectiveness and results were outstanding. Comparison with unsprayed areas showed that control due to spraying ranged between 99% and 100% effectiveness. New foliage grew in sprayed areas and even where spraying was late the budworm was halted in its tracks. By comparison, in unsprayed areas new foliage was eaten and the budworm 'population' remained high.

Long-term results are still being evaluated, but even now some definite facts are known. Trees can be protected from complete defoliation by the budworm in periods of heavy 'epidemics.' Aerial spraying is the answer and it passed a severe test to prove it. As for the upsetting of the 'balance of nature,' no adverse effects were noted. One welcome added effect was noticed. Mosquitoes and black flies were eliminated from the area for several weeks.

Through the full co-operation of all concerned the operation was a success with workers in many fields sharing a common interest in this pioneer undertaking. It has answered many problems involved in applying insecticide to large New Brunswick forest areas under tough conditions marking a new phase in aerial spraying there.

Budworm larvae dropping from the branches of this tree have festooned it with silk streamers, giving some idea of a budworm 'invasion'

Recent Developments in Italian Agriculture

(From our Italian Correspondent)

THE contribution of the Montecatini Co. to the development of Italian agriculture will soon be increased by two new manufacturing plants, in Ferrara and Novara, for the production of synthetic nitrogen fertiliser. Conceived on new lines these establishments will utilise a new source of hydrogen, methane, and represent the result of continuous research and improvements in nitrogen synthesis. The output (85,000 metric tons a year) will increase the productive capacity for synthetic nitrogen compounds of this company to more than 200,000 tons a year.

Montecatini activity on behalf of agriculture also includes research on methods of cultivation and fertilisation as well as technical assistance to farmers by their technical and agrarian staff. The results attained by this section have been reviewed in a series of recently released reports on experiments made in 233 fields all over Italy. The output of wheat in these testing fields has shown a 46% increase, thanks to a rational use of fertilisers.

Insecticides

A good deal of attention is being devoted in Italy to systemic insecticides and these are now finding their way on to the market. Considerable attention is also being paid to the use of sulphonates in the fight against the summer eggs of Red Spider, while dithiocarbonates are reported to be making progress in substitution for copper salts in dealing with fungoid diseases. Prices for many insecticides and fungicides have fallen considerably compared with the previous year.

Machinery developments

An excellent atomiser, especially developed to meet the requirements of Italian agriculture, has lately come on the market and has been received with favour. It is known as Berthoud 350 and consists of a fan driven by a four-stroke 7 petroleum h.p. engine that impels air at a speed of 240 km. per hour. The spraying fluid is injected into the air stream by a pump that also is used for stirring the mixture in the tank.

Another new development recently reported is that of a device for incorporating fertilisers with irrigation water and utilising manure heaps and the washings of steps. To obtain this cheaply and easily a special wash cart has been developed consisting of a robust frame carrying a cattle box fitted with two rotating feeders and five oscillating stirrers on the bottom.

From the Laeno, Milan, factory a novel device has recently come forward under the name of the Nembo irrigator intended to supply irrigated water in the form of a fine spray resembling rain, and includes a nozzle of decreasing section which determines the very exact subdivision of the water jets. The machine is provided with a wheel which enables the jet to be adjusted to any direction and enables the farmer to decide the best position from which to apply water.

The Ilcma Co. recently exhibited at the Milan Fair a new mechanical transplanter which is claimed to satisfactorily solve the problem of transplanting rice. The ideal transplanter for rice has long been sought in Italy and it is believed that the new machine solves the difficulty. It works by means of a series of continuously working circular tongs which are served by a particular feeding system. It is reported to be able to work on any type of ground and transplants 3 to 4 hectares in eight hours with a 50% saving of money.

Methane gas for farms

Attention has been directed to the preparation of the manufacture and use of methane gas in farm houses and farm buildings for lighting and heating, and a decision has been taken to organise a major demonstration of the practical utilisation of biological methane in this connection.

BRITAIN'S GREAT AGRICULTURAL SHOW — THE 'ROYAL'

THIS year the Annual Show of the Royal Agricultural Society of England was held from July 7 to 10 at the Lancashire seaside resort of Blackpool for the first time in the Show's history. The county of Lancashire, however, has seen eight Shows in the past, more than any other county in the kingdom, and all previous Shows have attracted large attendances. This year was no exception and the figures show that 118,291 people paid for admission during the four days of the Show compared with 93,318 at Newton Abbot last year.

Official exhibits

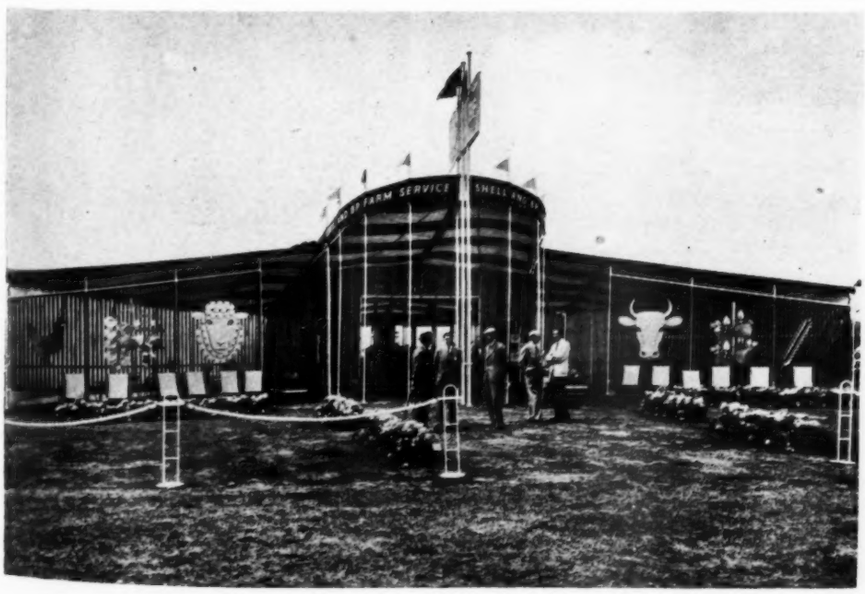
The highly-populated county of Lancashire is, agriculturally, a dairy farming area primarily, and many of the official exhibits at the Show emphasised milk production and methods of obtaining high output. The exhibit of the Ministry of Agriculture and Fisheries, for example, had as its main theme 'High Milk Output Per Acre' and the outdoor features demonstrated methods of production and utilisation of grass and fodder crops which enable high output to be obtained. It was shown that pasture yields can be increased by as much as 25% with the help of strip grazing; Italian ryegrass can be undersown in an arable silage mixture to extend the grazing season; an area of spring sown reseeding can boost the midsummer grazing shortage, examples of which were demonstrated in the outdoor plots. Indoors the conversion of an old cowshed into modern cowstandings and milking parlour was demonstrated and typical dairy cows from high-production Lancashire farms were shown, together with information on how the high production has been achieved.

Typical of the interest shown in machinery developments was the continuous throng of interested visitors on the Ford Motor Co.'s stand. The attractive stand shown in the photograph below is that of Shell and B.P. Farm Service

A feature of the Milk Marketing Board exhibit was the story of milk transport in the North of England, including the collection of milk from the farms by tanker.

The Forestry exhibit, which covered over 1½ acres, contained as usual competitive and non-competitive exhibits, including numerous tree and shrub varieties, timber specimens and examples of the products of Britain's timber industry from estates throughout the country. A huge felled cedar of Lebanon, 166 years old and over 7 ft. in diameter, attracted considerable attention; it had travelled to Blackpool from the estate of the Duke of Westminster at Assington in Suffolk, a distance of 200 miles.

A new attraction this year was the Wool Exhibition which gave fashion displays of women's clothes made from wool fabrics and designed by London's top 11 dress designers. Here the farmer and his wife could see and admire the diversity of end-products of the fleece off the sheep's back.



Silver medals

This year 620 stands occupying about 70 acres displayed many thousands of articles for the farmer from the smallest to the largest and ranging in price from pence to many thousands of pounds. There did not appear to be so much newly-designed or revolutionary equipment as was evident at the last 'Royal' or at the Smithfield Show in London—if one discounts a strange Heath Robinson-like contraption seen on one stand, described as a 'rotary niggler and fidgeter' and designed by the humorous artist Rowland Emmett—but the entries for the Silver Medal Competition for new implements were as numerous as ever, ten being accepted for final judging together with six deferred from last year. Four medals were in fact awarded, the Burke Perpetual Challenge Cup going to a firm who had their entry deferred from the Royal Show at Newton Abbot last year. The award was for a pea cutter and swather, a hydraulically-controlled front-mounted implement transmitting power

from the tractor power take-off to a forward-mounted chain-driven mechanism, which rotates the pick-up reel and drives the cutter bar and cross elevator.

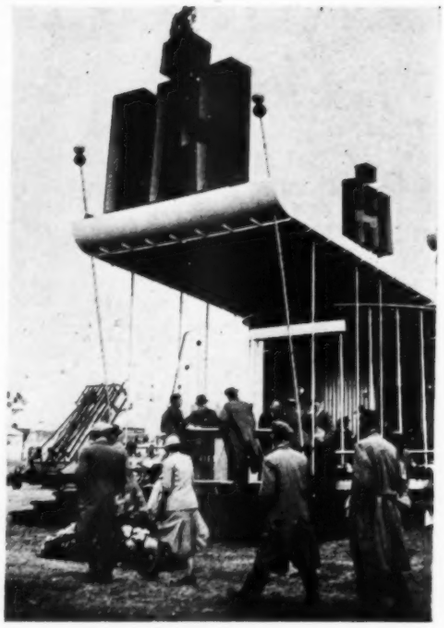
Other medals were awarded for a forage harvester employing a new cutting principle using unsharpened shears, severage being effected by impact; a direct-to-churn milk recorder, making possible in-churn milking and recording in existing cow houses; a pig feed mincer which breaks down and mixes most kinds of raw feedingstuffs in a few seconds.

1953 implements

Last month in WORLD CROPS a preview of some of the machinery exhibits at the Show was given and we continue our selection here.

Among the new implements on the Ford Motor Co.'s stand was a mounted hay rake approved for use with the Fordson Major, bringing into use the hydraulic lift and three-point linkage. Of entirely new design this range of hay rakes includes two models with raking widths of 9 ft. and 15 ft. respectively; transport widths are 8 ft. 9 in. and 6 ft.

An ingenious plough stabilising attachment was seen on the stand of Salopian Engineers, Ltd. (members of the Owen Organisation) and consisted of the 'Bulwark Cantilever Attachment.' This is a beam fitted along the tractor's side from about the position of the gear box to the left hand draught link of the plough, pivoted about half-way along its length. The plough's weight is transferred to the land wheel of the tractor along the stabiliser beam and ploughing depth is adjusted by a hydraulic cylinder on the tractor. Thus automatic depth control is claimed to be achieved, any surface undulations being offset by the operation of the hydraulic attachment.



The imposing entrance to the stand of the International Harvester Co.

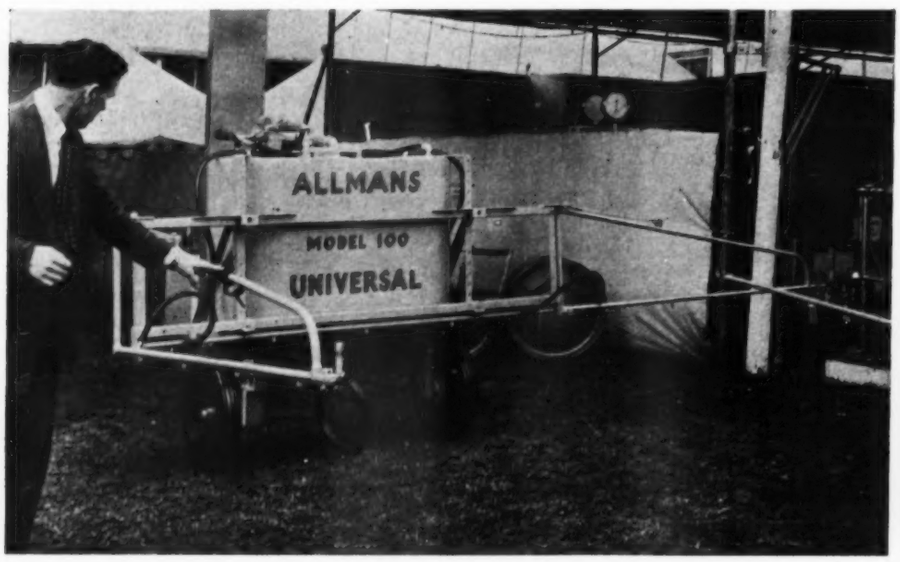
The Hosier-Bomford reversible plough was on view on the stand of Edward Curran Engineering Ltd., and attracted considerable interest; the plough was described in WORLD CROPS last year (November 1952, p. 396). Readers may remember that this plough has a single beam which turns over an arc of 90 degrees, the number and spacing of furrows being easily selected and adjusted.

This same firm has announced that they have now taken over the complete marketing of the I.C.I. Mk. III grass dryer and it will be known in future as the Curran Mk. III Farm Dryer. The expanded agricultural division of Edward Curran Engineering Ltd. will also continue to market the Slade-Curran Grass Dryer. To date sales of the two dryers account for nearly half the 1,100 grass dryers in the United Kingdom.

What is described as the only tractor-mounted hydraulic deep trencher and excavator in the world fitted with self-aligning buckets was shown on the stand of Whitlock Bros. Light enough to be carried on a Ferguson tractor, the digging ram nevertheless gives a thrust of over 6 tons to drive the bucket through soil to a depth of 6 ft. 6 in. and up to 2 ft. 6 in. in width. A single hydraulic pump is mounted in the centre of the machine and driven by the tractor p.t.o. through a Hardy Spicer universal coupling.

One of the new implements entered for the Silver Medal Competition and deferred for a further year was the Stanhay Seed Spacing Drill manufactured by Stanhay (Ashford) Ltd. It is made in separate units for toolbar attachment or for pushing by hand and drills seeds to uniform depth at any required spacing and row width, covering and rolling them in one operation.

A combined seed and fertiliser placement drill suitable for working on four rows at once, adjustable from 20 to 26 in. was exhibited by Russell's (Kirbymoorside) Ltd. It is manufactured both as a trailer model and for hydraulic mounting. It is described as being suitable for drilling seeds ranging in size from beans to turnips.

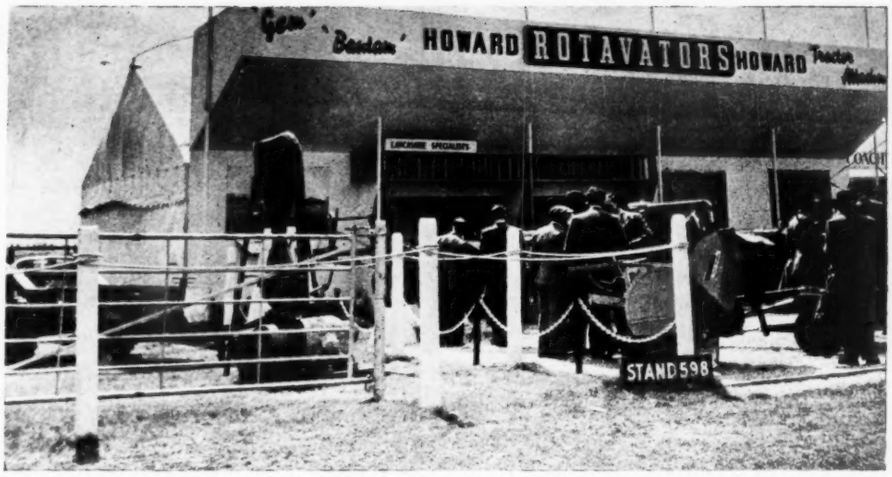


The Universal sprayer, on the E. Allman stand, has a capacity of 100 gal. and is supplied for tractor mounting or as a trailer model. (*Right*) **The Bulwark cantilever attachment, plough stabiliser, mentioned on this page**

A range of haymaking equipment was seen on the stand of Bamfords Ltd., a firm, incidentally, who state that nearly half of their total production is now being exported from the United Kingdom. Tractor trailer mid-mounted and semi-mounted mowers were displayed, all available with a 5 or 6 ft. cutting width.

A new combined tractor side rake, swath turner and tedder designed to handle two 5 ft. swaths was shown; also a mounted power driven swath turner and windrower for attachment to the tractor three-point linkage.

The machinery stands, of which we have mentioned only a cross-section in this and the preceding issues of WORLD CROPS, drew, as usual, great crowds and once again it was plain that British agricultural engineers are contributing in no mean fashion to the mechanisation of agriculture at home and, increasingly, overseas.



The full range of rotary hoes was on show on the stand of Howard Rotavators' Lancashire agent

Visitors

The Overseas Pavilion was well attended during the four days of the Show, many distinguished visitors having come from most parts of the world. In addition to the Commonwealth countries and America, parties came from many European countries including Germany and Sweden. From the Commonwealth countries a predominance of visitors from Australia and New Zealand was noted. A special pavilion was, for the first time, organised by the Royal Kenya Agricultural Society and displayed aspects of the farming life of that colony, which produces almost every form of agricultural product and has been described as the agricultural gem of Africa.

Many of the overseas visitors were especially interested to see the livestock exhibits, more particularly since foot-and-mouth disease prevented cattle, sheep and pigs from being shown at last year's Royal Show. This year at Blackpool perhaps the most spectacular sight was the cattle parade of prize-winning beasts, comprising over 300 animals representing the principal beef, dual-purpose and dairy breeds of the country together in the Grand Ring at one time. Here, indeed, was proof of Britain's reputation as the stud farm of the world.

It was interesting to note that the beef breeds are returning to their pre-war appearance of short-leggedness and compactness.

Among the many attractions put on in the Grand Ring almost continuously throughout the Show was the parade of 25 British and foreign tractors with mounted implements ranging from the baby Ransomes ' MG 5 ' horticultural tracklayer to the giant Vickers ' VR 180 ' crawler.

Officials

The President of the Royal Agricultural Society for 1953 is the Earl of Derby, M.C., and the Honorary Director of the Show Lt.-Col. Guy Blewitt, D.S.O., M.C. Next year the Royal Show will be held in the Home Park at Windsor.

Various machinery manufacturers come under one roof on the stand of the Owen Organisation

Royal Show, 1956

A deputation representing the Corporation of Newcastle-upon-Tyne and the Freemen of the city attended a council meeting of the Royal Agricultural Society of England recently to present the city's invitation for the Royal Show to visit Newcastle in 1956. The council unanimously agreed to accept the invitation. Welcoming the deputation, the president of the Society said that the Royal Show had been held previously at Newcastle six times—in 1846, 1864, 1887, 1908, 1923 and 1935.

Caterpillar Plant Manager

The announcement was made recently by the Caterpillar Tractor Co. of the appointment of Warren Kinsey, employee relations manager, as manager of the new plant planned by the company at a site not yet determined. He will assume his new duties immediately, but will not leave Peoria until sometime in 1954. The new plant is part of a $45 million expansion programme.

The Economy of Chemical Pest Control

R. J. COURSHEE, B.Sc.

National Institute of Agricultural Engineering, England

Chemical pest control is apt to be expensive and to be economic its cost must be reduced till it bears a favourable relation to the value of the resultant increment of crop. Below the author discusses some of the fundamental economic factors which govern the cost of spraying mainly from the point of view of the agricultural engineer.

CHEMICAL methods of pest control are among the more expensive of possible methods of increasing crop production. There is therefore considerable need for work to minimise costs and to assess them in relation to the value of the corresponding increase in yield.

The economy of the subject in fact provides a background for all work on pest control, and this note has been prepared to indicate the scope of the subject and some of the more general aspects of the problems involved.

Some basic considerations

The advantages of instituting a successful method of controlling pests may be viewed in several ways. Two considerations apply ; in the first place, by controlling pests a community is able to produce more food per acre and more food per man hour in exchange for expenditure of man hours on spraying and on making available chemicals and spraying machines. We are usually unable, however, to judge the budget on so broad a basis and consequently in the second place we need to consider the cash return to an individual grower in order to draw up a balance sheet.

These alternative requirements necessitate two different accounting systems. The wider aspect is important in relation to nationally or internationally planned attacks on a pest, and is bound to attract increasing attention as time goes by, but, meanwhile, most of the spraying in the world is done by individuals for personal profit. The latter provides a simpler problem in economics.

It is necessary to point out here that normally it is only the consumer who pays for pest depredations, and as has been shown by several writers the growers may or may not lose as the result of crop losses. If the yield falls prices may rise to such an extent that the grower may receive more for their produce than they can obtain in a year when yields are plentiful.

Nevertheless, there has however been a loss—the insects and fungi have eaten it—the cost of which falls on that part of the community which consumes that particular product and indirectly on the community as a whole.

The *real loss* is to be measured in terms of land, sunshine and man hours wasted in feeding a population which should not be fed. The magnitude of these losses is best expressed as a percentage of actual yield and, indeed, actual estimates of these losses have been prepared for German and American production. They show the average yield losses, after control measures have been applied and vary for different crops from a small percentage to as much as 20% for potatoes and tree fruits. They do not consider, however, fluctuations about this mean value which may be of great economic importance nor do they consider the distribution of losses, which may be negligible if thinly spread, but important if concentrated over a small part of the producing area; nor do they estimate the losses which would occur if no precautions were taken.

Assessing the value of pest control

In assessing the value of chemical pest control it is necessary to know firstly how much the yield is increased and how much this increase is worth in money. Thus, it may be far more suitable to the grower to step up glasshouse tomato yields of 60 tons per acre by 1% than it is to control grasshoppers in cereals eating 10% of the crop.

Secondly, we need to consider the importance of finding control methods which can be applied to major world crops and to judge the value of the control relative to the extra expenditure of efforts that large-scale application involves.

The value of the research work on a central method is based on the gross loss, *i.e.* the loss per acre multiplied by the number of acres used for a crop, but the value of doing the control work is based on the returns for expenditure in man hours.

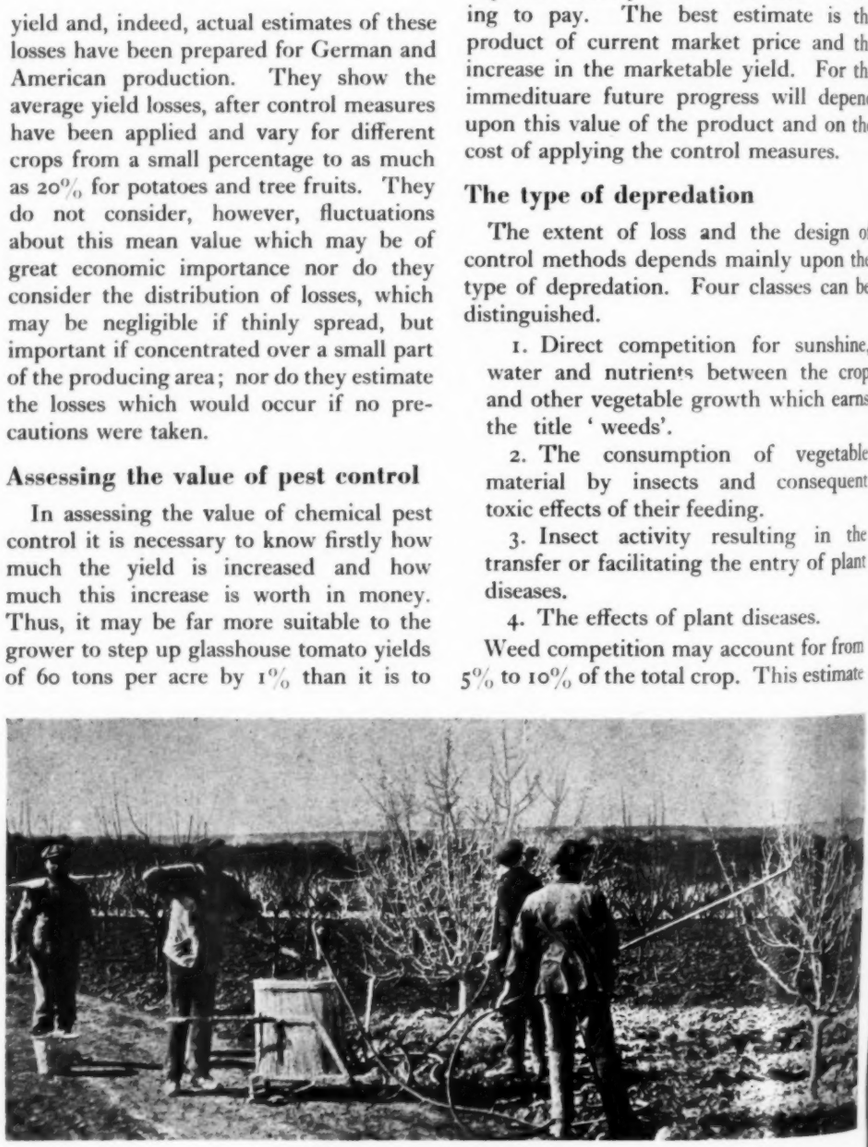
The value of pest control to the grower depends on the price the consumer is willing to pay. The best estimate is the product of current market price and the increase in the marketable yield. For the immedituare future progress will depend upon this value of the product and on the cost of applying the control measures.

The type of depredation

The extent of loss and the design of control methods depends mainly upon the type of depredation. Four classes can be distinguished.

1. Direct competition for sunshine, water and nutrients between the crop and other vegetable growth which earns the title ' weeds'.
2. The consumption of vegetable material by insects and consequent toxic effects of their feeding.
3. Insect activity resulting in the transfer or facilitating the entry of plant diseases.
4. The effects of plant diseases.

Weed competition may account for from 5% to 10% of the total crop. This estimate



Fruit spraying in Kent

Knapsack sprayers being used against blister blight in Ceylon

applies mainly to intensively cultivated crops which reach maturity in one or two years. No comparable estimates are available for plantation crops. The losses are on the whole regular and small, if we neglect the problem of the long-term decay of pasture land.

Insect consumption of plant material is also usually a minor problem in so far as direct losses are concerned.* The one exception is locusts in the swarming phase when a dense insect population suddenly concentrates on an area to such an extent that it is completely stripped of leaves. Losses also occur by insects causing injection of toxic juices into a plant. A further exception is that while insects may not appreciably alter the food value of a crop they may so affect its appearance as to ruin its market value.

Except for a few special cases an insect population is probably most dangerous because it may lead to the transfer of plant diseases which once established often result in very important losses.

These diseases, virus, fungicidal and bacterial, are the most difficult and the most important problem. Many cause complete loss of a crop under conditions favourable to their development, *e.g.* potato late blight. Virus diseases can be attacked chemically only by the control of the insect vector and one insect left alive can wreak considerable damage. Similarly, although the probability of attack by a fungus can be minimised by fungicides, accidental untreated patches are danger spots and possible sources of total loss. Therefore spraying against diseases and their vectors generally requires far more thorough treatment than that needed to reduce insect pests to tolerable dimensions. There are, of course, exceptions where diseases (many virus diseases for example) result in only a partial reduction in yield.

*Small only by comparison with 100% losses caused by other pests.

Pests of economic importance

This classification of the size of losses is useful for assessing the next stage—the monetary value of the losses. It is helpful to bear in mind the relative magnitude of the crops. Grass and grain are the most important crops in Great Britain. Grain is the primary crop of the world and a drop in production may result in the loss of a great quantity of food. This makes the control of grain losses the most urgent. Almost equally great losses occur in tree crops. They are not, it is true, of very great importance in world food production, but they are important for the production of materials other than food and losses are great because they are so very susceptible. Plantation block uniformity and the lack of a crop rotation may make it virtually impossible to produce fruit which can be sold without resort to chemical pest control.

It has often been said that chemical control should be used only as a last resort but tree fruit growing provides one obvious example where spraying is the first answer to any pest problem whether or not it can provide a satisfactory long term solution.

Finally, pests which can cause a great deal of damage for a short time at one point may be responsible for great local losses. Thus locusts are more important than grasshoppers although in fact the latter probably destroy more food.

Methods of control

Biological control is often said to be the most desirable method to employ, largely because it is usually cheap. The general designation biological control includes for example, the use of competing or parasitic organisms to limit pest development; it may also include the development of immune, tolerant or resistant crop varieties, as well as ecological control by crop rotation, host plant elimination, fertiliser application and so on.

Other methods are essentially biological in that their use alters the biological constitution of the plant environment, but where they can be shown to be the result of a known particular function they are usually designated physical or chemical control methods.

Thus treading on a wireworm is a biological process although it could be called physical control. The addition of cellulose to soil is a physical process but its action in supporting saprophytic organisms, to the detriment of less desirable, soil inhabitants, give it the right to be classed as biological control.

Accepted ' physical ' methods include, for example, altering climatic conditions and the soil pH, while, broadly speaking, they also include the exclusion of diseased material from a region by destruction or quarantine.

Chemical methods involve the use of a chemical to deter, kill or inactivate the pest. It may include fumigating, spraying and dusting, the disinfection of seed and soil and of the environment of stored harvested produce, as well as recent developments in systemic chemotherapy and prophylaxis.

The cost of chemical control

The financial cost of control is a convenient yardstick and provides a suitable way of comparing with the economic value of the increase in yield. Precise figures for specific methods are not widely available and similar operations for different crops may be differently priced.

An estimate may be made on the basis of the cost of materials used, the man hours required to apply them and the charge to be made to cover depreciation, maintenance and storage of the machinery used. Similarly, a further guess at the cost may be made from the charges of spraying contractors, for particular operations.

For most crops, the costs range between £2 and £5 per acre per application. Of this, materials account for up to 70% depending upon the amount used and the price. Labour costs vary widely from a few man minutes to two hours per acre depending on the method of application (which is determined largely by the type of pest and the crop). Machinery costs are more constant.

Special methods may involve costs much smaller or greater than these. Thus cereal seed disinfection costs only a few shillings per acre but soil sterilisation and disinfection may cost as much as £1,000

Spraying fruit trees in New Zealand

or as little as £150 per acre respectively. (The former figure is based on steaming the soil and the latter on formaldehyde disinfection at 2% to a six-inch depth.)

The advisability of applying chemical control

Possibly as great advances can be made in the sphere of estimating accurately when it is advisable to spray and when it will not be necessary, as in the development of cheap methods of control alternative to spraying. We have still to learn for most crops what is the maximum attack which can be tolerated. An infestation smaller than this value cannot be controlled economically. The magnitude of the loss which is to be permitted depends upon the cost of the control method and upon the value of the crop.

We should also be able to forecast the rate of growth of an infestation in order to know beforehand whether a small attack is going to reach epidemic proportions. The natural laws of the rate of growth of a population are beginning to become known and to provide the agricultural engineer with some working bases for preventative spraying.

The third point which requires elucidation is the relationship between the extent and the cost of the control. Spraying is often undertaken as a safety precaution to reduce risk of infection or to reduce pest populations to tolerable levels. It is uneconomic usually to aim at 99% control because of the difficulty and expense of achieving this; 90% control is almost equally effective and is very much cheaper. The point at which the difference between the increased return from spraying and the cost of the operation, is greatest, remains to be determined, bearing in mind such factors as the growth of the residual population and the possibility of reinfection.

The aim, therefore, should be to reduce to a minimum :

1. The costs of spraying materials by using them only when necessary and as efficiently as possible.

2. The time needed to do the work.

3. The cost of the machine which would also increase to a maximum the extra returns resulting from control.

Conclusion

This discussion may, it is hoped, help to indicate the wide range of the problem facing the biologists, who by their study alone are able to provide instructions to the agricultural engineer who must put them into practical application.

Australian Farming Notes

(From our Australian Correspondent)

Experimental rice crops

Results of the Commonwealth Government's experimental rice crops in the Northern Territory were encouraging, the Minister for Territories, Mr. Paul Hasluck, said recently. Crops sown at Humpty Doo on the Adelaide River plains would eventually give a pointer to the possible use of rice growing in an area of hundreds of thousands of acres in the Adelaide River-Marrakai district. Yields this year would be poor because of exceptional conditions and because seed used from the Murrumbidgee Irrigation Area was unsuitable for tropical conditions. The main problem, however, was not one of cultivation, but rather of water control.

Queensland crop acreage

The total area under crop in Queensland in 1951-52 was 2,021,201 acres, a decrease of 55,809 acres from the area of the previous year, but still well above the 1¾ million acres cropped at the beginning and end of the 1939-45 war. While most crops showed slight increases on their 1950-51 acreages, the area under wheat decreased by over 100,000 acres.

The area of sugar cane cut for crushing was 9,704 acres greater at 273,370 acres, but the yield per acre dropped by 7.1 tons to 18.3 tons. The quantity of cane cut (5,005,172 tons) was a decrease of 1,686,534 tons from the record harvest of 1950-51. The area of wheat (454,543 acres) was less than that of the four previous seasons, but still 62,211 acres more than the pre-war average. The total crop (6,631,644 bushels) was over 2 million bushels less than in 1950-51 and the yield per acre (14.6 bushels) 1.1 bushels less.

Maize acreage (111,181 acres) showed a slight decrease on the 1950-51 area and was 66,986 acres less than the pre-war average. The 169,558 acres of sorghum harvested in 1951-52 has given the crop a place with wheat and maize as one of the state's most important grain crops. Other crops included: oats, 20,839 acres; panicum, millet and setaria, 16,008 acres; barley, 28,158 acres; canary seed, 19,971 acres; lucerne hay, 29,971 acres; vegetables, 63,143 acres; fruit, 37,868 acres; peanuts, 13,312 acres; cotton, 4,480 acres; and tobacco, 5,038 acres.

Soil science conference

Soil scientists from all parts of Australia, together with scientists from New Zealand, India and Ceylon, have been attending a soil science conference in Adelaide, South Australia. The conference was concerned with recent advances in soil science and a wide variety of papers on soil investigations were presented during it. Research problems discussed by the conference covered a wide range, from soil fertility to road making.

Cotton Production in the British Commonwealth

Each year cotton production in the Commonwealth tends to increase. The position in the year 1951-52 and the outlook for production in 1952-53 are reviewed in the following pages which have been abstracted from the annual report of the Empire Cotton Growing Corporation.

COTTON production in the Dominions, Colonies and the Anglo-Egyptian Sudan in 1951-52 amounted to some 975,000 bales of 400 lb. lint. Although some 80,000 bales less than the previous season, it was still the second highest on record, and was all the more notable as it occurred in a year in which an unfavourable season resulted in production in the Sudan falling by over 200,000 bales.

In previous years two territories, the Sudan and Uganda, have dominated production, accounting for an average of over 82% of the total for the 10 years 1941-42 to 1950-51, the range varying from 79% to 88%. In the season under review these two countries accounted for only 71%, no less than four territories—Nigeria, Tanganyika, South Africa and Southern Rhodesia—having produced record crops. This expansion of cotton growing in other territories, if it can be continued, should help to stabilise production and overcome the seasonal fluctuations which are bound to affect individual territories.

Prices

In East Africa, Nyasaland and Nigeria the price to be paid for seed cotton is fixed in advance and any profit accruing to the Governments or Marketing Boards is used for development and research and to form price stabilisation funds. In the season 1951-52 growers in East Africa and Nigeria received 6d. per lb. for first grade seed cotton (equivalent to 20d. a lb. lint on the basis of a ginning outturn of 30%), and growers in Nyasaland received 5d. a lb.

The Raw Cotton Commission quotations for all types of cotton lint fell steadily throughout 1952, when the 1951-52 crops were being marketed. American middling, which was quoted at 45.50d. at the end of January 1951, had fallen to 32.30d. by the end of the year. This represents a drop of 29%, but with higher quality cottons the fall was accentuated, being 35% for Uganda BP52 and as much as 56% for first grade Sudan Sakel.

In the following, the reports on the commercial crops have been based mainly on information supplied by the Departments of Agriculture.

Anglo-Egyptian Sudan

Season 1951-52

Unfavourable weather and widespread attack by pests and diseases depressed yields in the Gezira very heavily, despite the spraying of over 200,000 feddans. The Tokar flood was the smallest, and the Gash flood the second smallest on record; additional areas planted under rainfall at Tokar yielded very little crop owing to subsequent lack of moisture. In all, the total production of Sakel type cotton amounted to less than half the crop of the previous season.

By contrast, production of American type cotton was easily a record. The raingrown crop was double the 1950-51 figure, owing to a very large increase in Kordofan, where an extended area was accompanied by higher yields. The crop of irrigated American type cotton also showed an increase of slightly over 50%.

Overall production of all types of cotton in 1951-52 was about three-fifths of the 1950-51 record. (Table 1.)

Season 1952-53

Production of Sakel type cotton revived considerably; the estimate at the time of writing amounts to upwards of 370,000 bales. Quality is, however, disappointing, and very few areas have lint in the top grades, since hot weather and extensive whitefly damage are believed to have caused the crop to open much more rapidly than usual. After a heavy flood in the Gash some 30,000 feddans were sprayed from the air against thrips and jassid in the first large-scale spraying operation to be attempted there; it is hoped that the crop will establish a new record.

Production of American type cotton is estimated at about 60,000 bales. At one time it appeared that the Nuba Mountains crop would exceed the 1951-52 record, but unfavourable weather and blackarm and bollworm attack led to a reduction in the estimate. In Equatoria there has been very heavy damage by pests after an early cessation of the rains, and yields are poor.

Uganda

Season 1951-52

The cotton crop was planted under reasonably favourable conditions and the final acreage was estimated at 1,517,716 acres. Abnormally wet weather during the last quarter of the year caused some boll rotting and loss of the early crop, but the final yield was above average. 221,892 tons of seed cotton were purchased and

TABLE 1

	1951-52				*Estimates for* 1952-53	
	*Area : Feddans**	*Crop : Kantars†*	*Kantars per Feddan*	*400-lb. Bales*	*Area : Feddans*	*Crop : Kantars*
Sakel Type :						
Sudan Gezira Board Sakel X.1730	122,495	382,785	3.12	—	119,314	—
	98,455	302,806	3.07	—	115,401	—
Total Gezira	220,950	685,591	3.10	179,494	234,715	1,085,900
Tokar Delta	31,997	21,064	.66	5,660	27,000	38,750
Gash Delta	37,661	66,306	1.76	16,463	70,000	120,000
Others	53,769	142,900	2.66	38,326	68,346	253,120
TOTAL SAKEL	344,377	915,861	—	239,943	400,061	1,497,770
American Type :						
Irrigated	14,579	38,865	2.66	9,516	11,890	28,208
Raingrown	191,528	258,317	1.35	63,427	182,000	216,784
GRAND TOTAL	550,484	1,213,043	—	312,886	593,951	1,742,762

* 1 Feddan = 1.038 acres. † 1 Kantar = 312 lb. seed cotton.
Average G.O.T. for the whole 1951-52 crop (all grades combined).
Sakel Type 33.64%
American Type 31.47%

TABLE 2

TANGANYIKA
COTTON PRODUCTION
(Bales of 400 lb. lint)

Province	1939/40-48/49 (average)	1948/49	1949/50	1950/51	1951/52 (estimated)
Lake	35,122	37,361	38,905	42,349	70,750
Eastern	9,786	12,579	8,433	3,047	6,300
Northern	1,253	398	1,356	1,923	646
Tanga	1,010	666	849		
Southern	755	304	172	145	179
Total	47,926	51,308	49,715	47,464	77,875

production amounted to 380,257 bales of 400 lb. lint.

Season 1952-53

The crop was planted under difficult conditions, owing to a prolonged and intense dry spell in June and July, and as a result the proportion of early planted cotton was less than usual. More favourable planting conditions occurred in August and the final acreage of 1,470,899 acres was only slightly less than that planted in the previous season. Seed dressing with Perenox to reduce damage from bacterial blight was extended in the Eastern Province and introduced for the first time in a portion of Buganda Province with very favourable results in both areas.

The autumn rains were generally light and because of this and because of the large proportion of late plantings, yields are expected to be low. The season was, however, remarkable for the low incidence of pests and diseases, so that grade is expected to be above average. The estimated production is 320,000 bales of 400 lb.

Kenya

Season 1951-52

This season 1,400 tons of S47 seed were imported from Uganda to replace BP52 in North Nyanza and the Samia district of Central Nyanza, the rest of the Nyanza Province being planted with N17. Heavy rains throughout the season enabled late-planted cotton to produce a good crop, and this, together with the higher price of 49 cents of a shilling per lb. of seed cotton which was paid to the grower, led to an increase in the total crop from 8,594 to 11,447 bales.

In the Coast Province, the crop was late planted owing to excessive rain at the normal planting date and the failure to germinate of the seed reserved for planting, which had to be replaced by N17 from the Nyanza Province. In the circumstances, the final production of 4,435 bales was considered to be satisfactory.

Tanganyika Territory

Season 1951-52

The territorial crop of 77,800 bales was a new record, surpassing the 72,700 bales obtained in 1940-41. The increase to 6d. per lb. in the price paid for seed cotton undoubtedly resulted in the planting of larger acreages, but it is considered that the expansion of Lake Province production from 42,000 bales to the record of 71,000 bales was due mainly to other factors. These included:

(1) The campaign for better land preparation and earlier sowing, carried out by field officers and agricultural instructors, assisted by early and ample rains.

(2) The use of Uk46, produced at Ukiriguru, over the whole province.

(3) Freedom from severe damage by pests and diseases.

Dr. J. B. Hutchinson, C.B.E., director of the research station at Namulonge, examining cotton plants for wilt disease, aided by an African assistant

In the Eastern Province, production by non-native growers, who were no longer allowed to deliver ungraded seed cotton to the ginneries, declined sharply; in contrast, deliveries by native growers were three times the 1951 figure, the increase being mainly attributable to the higher price and the generally better season. Small quantities of cotton were grown in the Southern and Tanga Provinces; in the Northern Province an increased acreage was planted as a result of the higher price, but bad weather depressed the yield.

Season 1952-53

Weather conditions have prevented early planting in the Lake Province and, as far as can be foreseen at the time of writing, crop prospects are by no means good. (Table 2.)

Nyasaland

Season 1951-52

In an attempt to control the red bollworm the 1951-52 cotton was planted early in pure stand instead of being intercropped with maize. The whole of the crop in the Southern and Central Provinces was uprooted and burned by the end of July as compared with the end of October in previous years. This technique proved most successful and in the Lower River District, where the bulk of the crop is grown, the average yield was 479 lb. seed cotton per acre.

In the Protectorate as a whole 45,168 acres of cotton were grown, producing 12,557 bales of lint, an average yield of 111 lb. lint or some 330 lb. seed cotton per acre. This was a big improvement on the previous season, when only 3,884 bales were produced. The price paid to the grower for seed cotton was 5d. per lb.

Season 1952-53

The crop has made a good start and it is hoped that total production will be at least as high as in 1951-52.

Southern Rhodesia

Season 1951-52

Cotton production in 1951-52 totalled 9,475 bales, more than double that of the previous year and the highest ever recorded there. This was achieved in spite of the fact that the native grown crop was a partial failure on account of excessive rain in December 1951, and January 1952. The quality of the crop was a little below average on account of blackarm and stainer damage. The price paid to growers for Class I seed cotton was 10d. per lb.

Season 1952-53

Prospects for the 1952-53 season are favourable, widespread and adequate rain-

The Cotton Research Station of the Empire Cotton Growing Corporation at Namulonge in Uganda

fall in December and January giving the crop a good start.

South Africa

Season 1951-52

Largely owing to the high price of cotton, much greater interest was taken in cotton growing in the 1951-52 season. The total acreage was approximately 80,000, some 70,000 acres of dryland cotton in the Transvaal, Natal and Swaziland, and 10,000 of irrigated cotton in the Orange River area.

Total production, estimated at 35,000 bales of 400 lb., was a record, easily surpassing the crop of 20,000 bales of 1925-26. The Orange River area produced 12,000 bales—a yield of some 500 lb. lint per acre —and the dryland area 23,000 bales—a yield of about 130 lb. per acre. Insect damage was much less than in the previous year.

Season 1952-53

The area planted for the 1952-53 season was about 25% less than for the previous season. This was mainly due to a very serious drought which was not broken until November. In some areas also red bollworm has caused serious damage, so that the total crop, tentatively estimated at 18,000 to 20,000 bales, will be much less than in 1951-52.

Nigeria

Season 1951-52

Purchases for export from the Northern Nigerian crop were an all-time record, representing an increase of nearly 50% on the previous record achieved the year before.

The selling price of 6d. per lb. of seed cotton, and favourable weather, in particular quite exceptional late rains continuing into November, were mainly responsible for the increased crop. The total amount of seed issued for planting was 17% higher than in the previous year; in addition, the distribution of seed of 26C was extended considerably, 5,438 tons of this variety being used compared with only 1,834 tons in the previous year.

The following table shows the purchases for export of American cotton in the Northern Provinces in recent years:

Year	*Bales of 400 lb.*	*Price of NAI seed cotton in pence per lb.*
1944-45	12,451	1.7
1945-46	33,794	2.1
1946-47	32,620	2.7
1947-48	18,445	3.0 (rising to 3.5)
1948-49	47,904	4.0
1949-50	57,057	4.0
1950-51	75,053	4.0
1951-52	110,534	6.0

The figures shows that the 1951-52 crop was nearly nine times as great as that exported eight years earlier, and the price paid for it was over three times as great, so that the total return received by the growers was over 30 times the amount received in 1944-45.

Season 1952-53

Seed issues for the 1952-53 season showed a further increase of 17%, but unfortunately this early indication of an increased crop has not been fulfilled.

The main reason for the decreased export crop, which is expected to amount to 80,000 to 90,000 bales, is considered to be late planting, which was general over the whole territory. There were a number of reasons for the late planting, some of which were:

(1) Unsatisfactory early rains.

(2) The movable fast of the month of Ramadan, which this season coincided with the time of planting.

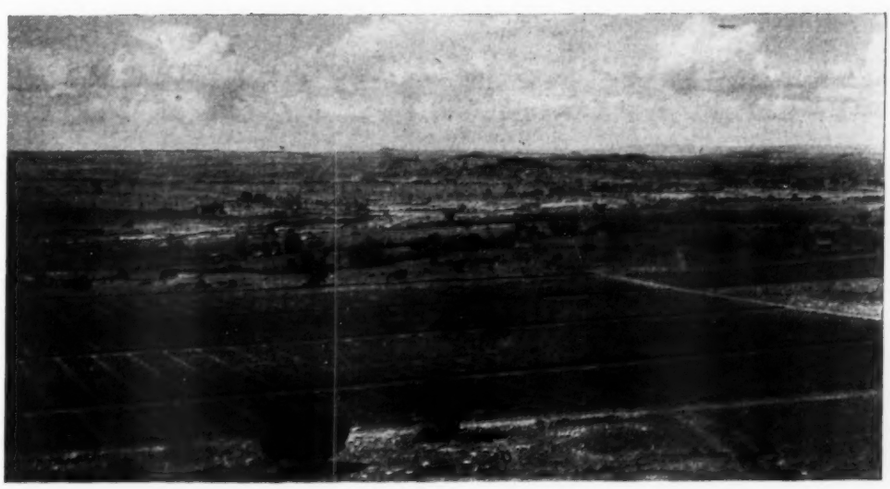
(3) Over-confidence in late planting on the part of the growers following last year's profitable crop.

(4) A larger proportion of new and inexperienced growers.

Aden

Season 1951-52

Some 9,000 acres were planted to cotton in Abyan, but there was a noticeable deterioration in the standard of cultivation, in spite of the payment, or offer of payment, of 90s. per acre on account of planting, thinning and clearing. This, and a very hot spell in October, reduced the seed cotton yield from 1,330 in 1950-51 to 806 lb. per acre. In addition, some 400 acres were planted in both Ahwar and Yeramis, yielding about 1,150 lb. seed cotton per acre, and 30 acres in Lodar (950 lb. p.a.).



Experimental plots on the Government station at Ukiguru, Tanganyika Territory

TABLE 3

1951-52 Crop (Montserrat and St. Kitts 1952)

	Acreage	Total Lint		Price
		400 lb. Bales	Yield in lb. per acre	Pence per lb. clean lint
Sea Island—MSI :				
Antigua	3,906	1,543*	158	52d-55d
Montserrat	3,583	1,215	135	64d-67d
Nevis	3,042	1,423	187	52d-55d
St. Kitts	535	236	176	64d-67d
Anguilla	90	19	83	64d-67d
TOTAL MSI	11,156	4,436	157	—
Sea Island—Superfine :				
St. Vincent	3,473	967	111	75d
Barbados	126	23	75	75d
TOTAL SUPERFINE	3,599	990	110	—
TOTAL SEA ISLAND	14,755	5,426	147	—
Marie Galante :				
Carriacou	3,300	384	46	—
TOTAL CROP	18,055	5,810	—	—

*Including 232 bales of VH8 for which 66d per lb. was offered.

Total production of lint in the four areas amounted to 7,206 bales of 400 lb.

The price paid for seed cotton in Abyan (in addition to the cultivation payment of 90s. per acre) was 60 cents of a shilling (7.2d.) per lb., of which the tenant received 30 cents, the Abyan Board 15 cents, the landowner 12 cents and the State 3 cents.

Season 1952-53

Some 7,000 acres were grown in Abyan, 600 acres in Yeramis, 500 acres in Ahwar and 200 elsewhere. With better attention to thinning and weeding it is hoped that the Abyan yield will be restored to some 1,200 lb. seed cotton per acre, and if these hopes are realised the total crop may be in the region of 8,000 bales.

Australia

Season 1951-52

There were three major stimulants to cotton planting in Queensland at the beginning of the 1951-52 season: an assurance of a satisfactory price, continued evidence of the value of cotton in rotations, and the knowledge that mechanical harvesters would be available on contract to handle much of the crop.

Unfortunately, although seed sufficient to plant 15,000 acres had been distributed, plantings were drastically reduced because of the severe drought, while much of the cotton planted suffered in various degrees. Total production showed an increase over the previous season, a crop of 1,937 bales of 400 lb. being produced from 4,145 acres, giving a yield of 179 lb. lint per acre.

About 30% of the crop was harvested by means of mechanical harvesters owned by the Cotton Marketing Board. The Board's fleet now consists of 12 harvesters, which should be ample during the next few years to harvest the bulk of those plantings which are adapted to machine harvesting.

Season 1952-53

Seed sufficient to plant 16,000 acres was applied for at the beginning of the season, and excellent planting rains occurred in October. The early development of the crop was good, but a drought subsequently retarded growth.

West Indies

Season 1951-52

The area planted to Sea Island cotton—almost 15,000 acres—was slightly higher than the average of the previous three years. Despite the unfavourable season in Antigua and Montserrat, and heavy bollworm losses in St. Kitts, total production showed little change, as the lower returns from these islands were balanced by an excellent crop in Nevis.

The superfine section, almost entirely from St. Vincent, increased by 10% over last year. In this class the feature was the arrival on the market of VH8. Some 230 bales of this variety were grown in Antigua to test the market and to provide seed for the replacement of MSI in Antigua and Nevis should a change be desirable. (Table 3.)

Season 1952-53

The change in the method of purchase, with markets and prices no longer being guaranteed in advance of planting, will affect acreages, especially in islands where alternative crops can be grown. Of those islands which plant in September, Antigua and St. Vincent have both shown considerable reductions, to approximately 1,300 acres and 2,000 acres respectively. In Nevis the acreage planted to cotton was about the same as last year, but the yield will be less because of dry conditions.

Photos : P. 372 C.O.I., p. 373 Empire Cotton Growing Corporation.

WORLD CROPS

Two articles on **Cocoa** will be included in our next issue. In addition, **Fertilisers in Economic Use** will be discussed by D. P. Hopkins, while R. Maclagen Gorrie will be describing **Aerial Photography as an Aid in Planning Improved Land Use and Flood Control.** There will also be additional articles, besides the usual features.

Glasshouse Crops Research Institute

The English Minister of Agriculture and Fisheries, on the advice of the Agricultural Research Council, is establishing a new independent agricultural research institute to promote research on the cultivation of glasshouse crops and mushrooms, and of bulbs, flowers and shrubs grown in the open. A site has been acquired at Toddington, near Littlehampton, and a beginning has been made with the provision of glasshouses and buildings.

It is intended that the new station will, as soon as facilities are available, take over the staff and work of the experimental and research station at Cheshunt which was established, largely on the initiative of the Lea Valley Growers, in 1913. This development has been necessitated by the restricted character of the facilities at Cheshunt and by the fact that the growing conditions there, particularly in regard to light, are not sufficiently good to enable research to be conducted efficiently.

The new institute will take the form of a company limited by guarantee but having no share capital, and it is expected that legal incorporation will be completed by the autumn. Mr. T. Ainslie Robertson, who is at present the chairman of Plant Protection Ltd., has accepted the Minister's invitation to be the first chairman of the new governing body.

Harvesting Flax Crops in Australia

W. L. GREENHILL, M.E.

Officer-in-charge, Plant Fibre Section, Commonwealth Scientific and Industrial Research Organisation

Flax has been grown for many years in Australia where a technique of harvesting by means of a reaper and binder has been evolved which is considered on balance to offer advantages over the conventional method of harvesting by pulling. Recently, also, success has followed attempts to harvest short and lodged crops by means of a combine followed by a pick-up baler. These developments are described below.

ALTHOUGH it is one of the world's oldest industries, the production of flax fibre has also been one of the slowest to adopt mechanical methods. In fact, the production of flax is, even today, essentially a small farmer industry in many countries. The conventional method of harvesting is by pulling the straw out of the ground. In this way, part of the roots remains attached to the stem and the whole of the fibre, which extends down to the ground level, is harvested.

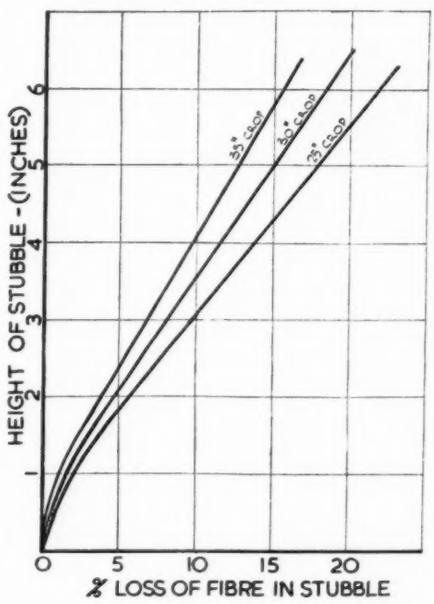
Pulling flax and tying it into sheaves by hand has for long been the accepted method of harvesting and is still quite common, although it is extremely labourious and, in countries with even moderately well paid labour, very expensive. Many attempts have been made during the past thirty years or so to develop flax pulling machines. These have gradually been improved and today may be regarded as mechanically successful ; their operation and maintenance costs have been reduced and their use has made the cost of harvesting flax in many countries only a fraction of that of hand pulling.

Australian practice

Although flax has been grown in Australia for many years, the industry reached really substantial proportions only during the last war when, for several years, about 60,000 acres were grown. To have manufactured pulling machines to handle this large acreage would have placed a heavy demand on an already overloaded engineering industry. Furthermore, some experience had previously been obtained with the pulling machines then available and this was far from encouraging. It was decided, therefore, that instead of pulling and despite the loss of fibre which would result, the crops should be cut and tied into sheaves by the conventional reaper and binder, numbers of which were already widely available in Australia. Despite disparaging comments at such an unorthodox procedure, this has since remained the most common method of harvesting flax in Australia.

The crops are usually reaped when the stems have just turned from green to yellow and most of the seeds have become firm and brown. At this stage the stems are still sappy but, provided the reaper and binder is in good mechanical condition, harvesting presents no difficulties (Fig. 1).

Fig. 1—Harvesting a flax crop with reaper and binder. Fig. 2 (*Below*)**—Loss of fibre in flax crops harvested by cutting instead of pulling (N.B.—(1) Height of crop taken from ground level to centre of branches. (2) Fibre content per inch of stem below 2 in. is two-thirds as much as above 2 in.)**



Cutting v. pulling

It is of interest to compare the relative merits of cutting and pulling.

Cost and Maintenance of Equipment

The initial cost and the maintenance of a pulling machine is much higher than that of a reaper and binder. At present, pulling machines are not manufactured in Australia and obtaining spare parts is slow and costly. Individual flax growers could not afford their own pulling machines which would have to be owned by the flax mills and would thus represent a heavy financial burden for the processor.

An Australian manufactured reaper and binder with a 6 ft. wide cut costs approximately £A330 today. With a tractor drive it will harvest up to 15 acres of flax in an eight-hour day. A modern pulling machine with about the same capacity has been quoted at nearly £1,700, exclusive

of any duty. Reaper and binders with 8 or 10 ft. wide cuts are also available and such machines have a correspondingly greater capacity. They are not, however, generally favoured for flax harvesting as they tend to be more wasteful than the smaller machine. Overall costs of harvesting by pulling machines in Australia are estimated to be more than twice those of harvesting by reaper and binder.

Fibre Recovery

The loss of fibre incurred when flax crops are harvested by reaper and binder is considerable. The actual percentage, determined by careful experiment, is shown graphically in Fig. 2. It depends, of course, on the length of stubble and on the height of the crop. In an Australian survey of nearly 200 crops in 1946 and 1947, the average height of crop from ground level to the centre of the branches was 34 in., and the average height of stubble 4.8 in. This represents a loss of 13% of the total fibre. Realising the seriousness of such a loss, increased efforts have been made to reduce this by encouraging more careful preparation of the soil so that the crops can be cut with a shorter stubble. Even so, the loss of fibre is probably still at least 10%. Furthermore, the fibre lost is, unfortunately, from the better end of the strands.

Effects on Processing

It has not proved feasible with the standard reaper and binder to harvest crops at as early a stage of maturity as is recommended overseas. This may result in some loss of quality in Australian fibre but, on the other hand, the need for recovering as much seed as possible would frequently render very early harvesting unacceptable in any case.

Fig. 3—A modified header for removing seed from a flax crop

With pulled straw at least 20% greater weight must be handled than with cut straw for only about half this percentage extra fibre. On the other hand, the roots are an advantage in that they provide the sheaf with a waist so that it holds together better than does cut straw.

The roots are a disadvantage however during deseeding and scutching since they make both spreading and butting more difficult. During the drying of water retted straw, however, the roots serve a useful purpose in keeping the fibre away from the ground. Apart from a tendency for over-retting at the extreme butt end of cut straw, there is no appreciable difference between the behaviour of cut and pulled straw during the retting operation.

In some cases, the longer fibre from pulled straw has a greater value per ton, particularly so when the cut fibre is too short for hackling and must be carded, whereas if the straw had been pulled, it could have been prepared on a 'line' system. Accordingly, even where cutting is the accepted practice, it may be advantageous to have available a few pulling machines for harvesting short crops.

Dual harvesting

In an effort to reduce the cost of harvesting and processing, a technique known as 'dual harvesting' was introduced in 1941. A modified wheat header first removed the seed (Fig. 3); this was followed by a reaper and spreader (Fig. 4) which cut the straw and spread it in rows where it was left to dew ret. A third machine, a pick-up binder (Fig. 5) finally gathered the straw and tied it into sheaves.

Although this method of harvesting appeared to have much to commend it from the point of view of reducing the handling of the straw, it did not prove successful and eventually was abandoned entirely. The main reason for this was the difficulty of dew-retting during the summer months which succeeded the harvesting (in Australia flax is sown in the autumn and harvested in the spring). This was often prolonged for several months thus holding up cultivation of the land and frequently resulting in a very low grade fibre.

Use of a thresher combine

During the past fourteen years quite a number of flax crops have been wasted in Australia either because they would have been too short for normal processing or because they were too badly lodged to be

Fig. 4—The reaper spreader used in conjunction with the header (Fig. 3) for harvesting flax crops

harvested in the form of sheaves. This loss of crops discouraged many growers and contributed in no small measure to the heavy fall in flax acreage in Australia from 1946 onwards.

In 1951, investigations were initiated by the Plant Fibre Section of the Commonwealth Scientific and Industrial Research Organisation with the object of salvaging these reject crops. The method of harvesting which has shown most promise here has been to use a thresher combine (Fig. 6) followed by a pick-up baler.

The crop is left to become well ripened before harvesting and the combine is adjusted to cut at ground level so that all the straw passes through the machine. A special attachment is used to raise lodged crops. The seed is separated and collected in a hopper ; the straw falls on the ground in windrows ; broken bolls and chaff are also left behind. The straw is subsequently collected and baled by means of an automatic pick-up baler.

In the investigations so far carried out, the bales of straw have been water retted intact, the retting proceeding in much the same way as when the straw is in sheaves. The bales are subsequently broken and the straw spread loosely by forks for drying after which it is gathered together and fed through tow cleaning machinery. This simple processing has produced a high grade tow for which there is normally a keen demand.

When it is remembered that the fibre from short crops is often suitable only for carding even after it has been harvested in sheaves and scutched, the economic advantages of the above harvesting and processing technique are even more apparent. In actual tests where costing has been carefully carried out, it has been shown that many crops which would otherwise be abandoned, may in fact, yield very satisfactory returns to both grower and processor.

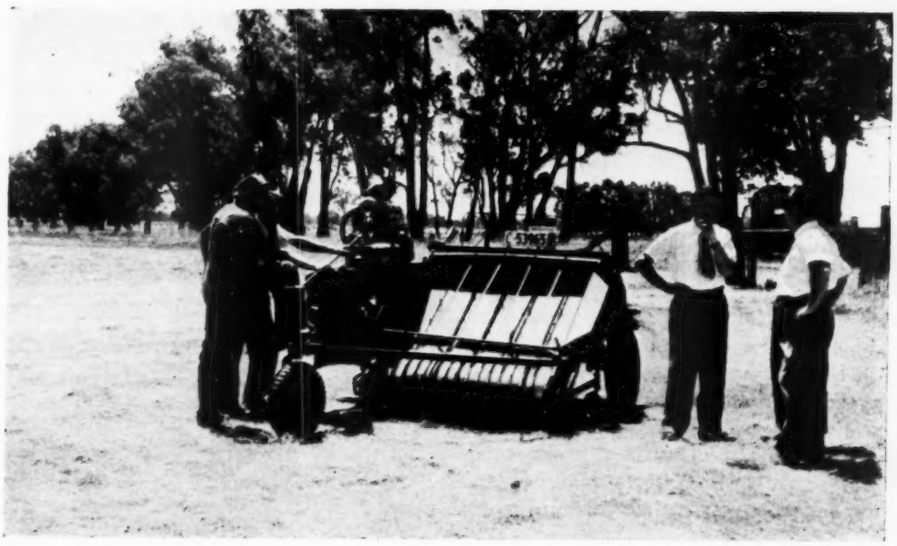


Fig. 5—A pick-up binder for gathering dew-retted straw and tying into sheaves

Thresher combine machines are now fairly widely distributed in flax growing areas in Australia and ' custom balers ' are always ready to assist growers who may not have their own pick-up machines. So encouraging have been the results of these preliminary tests, that the Flax Production Committee (which controls all but one flax mill in Australia) has recently purchased a thresher combine to be used in any district where the number of crops to be ' salvaged ' might otherwise prove embarrassing for local equipment.

The thresher combine might well prove an economical way of harvesting linseed crops from which the straw is to be used to provide fibre for paper making or for cheap yarns. For such purposes the fibre would be separated from the straw by mechanical decortication without retting. At the present time, however, there appears to be little demand in Australia for such fibre.

Fig. 6—A thresher combine harvesting a lodged flax crop

Superphosphate Association Meeting

Recently the International Superphosphate Manufacturers' Association held its annual series of meetings in Stockholm, at which some 280 delegates were present from 20 different countries, including representatives of the industry from New Zealand, India and the U.S.A.

Delegates were entertained at a cocktail party in the Technical Museum of Stockholm and a banquet in Stockholm Town Hall by the Swedish superphosphate manufacturers, who were also the hosts at an opera and ballet performance in the theatre of the Palace of Drottningholm. Visits were paid to the superphosphate works of A.B. Förenade Superfosfatfabriker at Norrköping and to those of Gäddvikens Superfosfatfabriks A.B. in Stockholm.

The Desert Locust Plague

The following countries were known to be infested by desert locust swarms or hoppers during February 1953. Newly invaded territories are indicated by asterisks.

India	British Somaliland
Pakistan	Ethiopia
Iran	Sudan
Iraq	*Egypt
Jordan	Kenya
*Israel	Uganda
Oman	Tanganyika
Saudi Arabia	Chad Territory
Socotra	French Niger

The International Sugar Conference

Great interest has been shown in the International Sugar Conference which has been meeting in London. We reproduce below a discussion of the present position, taken from Messrs. C. Czarnikow's 147th Review of the Sugar Industry.

THE International Sugar conference which was called by the United Nations Organisation at the request of the International Sugar Council, opened in London in July. The object of this conference is to negotiate the setting up of a new International Sugar Agreement in replacement of the 1937 agreement which, whilst maintained by protocols, has been inoperative since the beginning of the last war. The agreement would have as its main purpose the limitation of price movements within a reasonable range and to this end would regulate supplies to the absorptive capacity of the free market.

The Brussels Convention

It is perhaps not without interest to recall that it is now just over half a century ago when, on March 5, 1902, the so-called Brussels Convention was signed at that city, to become effective on September 1, 1903. Far from being designed to limit production, that convention had as its aim ' to equalise the conditions of the competition between beet and cane sugar from various countries ' by the abolition of all forms of production and export bounties, direct or indirect, which had become fairly common amongst certain European beet sugar countries. The convention had one object in common with its successors, namely, that of ' promoting the consumption of sugar.' Originally in force for five years, this convention was subsequently prolonged with a few modications until it was automatically terminated on the outbreak of war in 1914.

The inter-war period

The events which necessitated the limitation of supplies during the inter-war period will still be fresh in the memory of many attending the conference. The fact that the various schemes devised during that period, whilst being instrumental in reducing the heavy weight of surplus stock, failed to raise prices to a level which could be considered to bring a fair return to the producer, will also be remembered. The average price of 9s. 0½d. per cwt. c.i.f. Europe for 96° raw sugar in 1929, itself representing a substantial fall from the levels of the previous few years, was followed by a sharp drop of nearly 2s. 6d. per cwt. to 6s. 7d. and eventually even to as low an average as 4s. 8d. in 1935. In 1934, a low point of 3s. 10½d. c.i.f. (3s. 2½d. f.o.b. Cuba) was touched. Incidentally, the gold parity of this price was 2s. 4¼d. per cwt. c.i.f. This was a time of disaster for all producers.

Apart from the economic upheaval which followed the first World War, the elimination of the European beet sugar bowl upset the balance between beet and cane sugar production which had been maintained during the early years of this century and this became an important element in the statistical disequilibrium which was later experienced.

Prior to that war, beet and cane production were approximately equal at around 9 million tons each. The cutting off of the Central European supply as a result of the war encouraged the large cane producers such as Cuba and Java to increase their output, a process which was later further stimulated by the exaggeratedly high level of prices reached in 1920, when raws in the New York market touched 22½c. c.i.f., and sugar on this side advanced to over 120s. per cwt. Cuba, whose production was around 2½ million tons at the outbreak of war, found an expanding outlet in the U.S.A., as well as in the open market (mainly, of course, in Western Europe), and by 1919 the crop had reached nearly 4 million tons. It was not until 1924 that she exceeded that figure, but in the following year Cuba had produced well over 5 million tons and showed every prospect of adding yet another million tons to her output.

Production in Java was similarly stimulated by the wave of demand and the dizzy heights to which prices had soared. Later on, however, output was raised considerably by the introduction of P.O.J. cane bred in Java, which not only resisted disease and withstood drought, as well as excessive moisture, but added greatly to the tonnage of sugar per hectare.

As an example of the advance in yields, the sugar output per hectare in 1919 was barely 10 metric tons; ten years later the yield was 50% higher and, under crop restriction conditions when no doubt the best land was used and the crop was ground at optimum yields, it reached 17⅞ tons. Increases in cane output of a less spectacular nature were going on elsewhere, including British Commonwealth countries. Improved cane varieties and greater efficiency in field and factory were having their effect.

In the meantime, the beet sugar industry in Europe was fast recovering after a somewhat slow start and by 1930 the world output of beet sugar was over 11 million tons. This was nearly 3 million tons over the pre-1914-18 war total, but was nevertheless only 40% of the overall world sugar production.

Outlets were not, however, increasing at the same rate as output. The world was impoverished by war; purchasing power in the more backward areas where there was most room for consumption expansion could not hope to keep pace with the increase in the world supply. Heavy surpluses were threatening.

Cuba foresaw the danger ahead and, realising her vulnerability, took the first step, under the initiative of Colonel Tarafa, to limit output for three years. The crop was first restricted under governmental decree in 1926. Attempts to induce other exporting countries to follow her example failed and restriction was abandoned in 1929, when Cuba again made over 5 million tons.

The Chadbourne Agreement

Meanwhile, Mr. Thomas L. Chadbourne, accompanied by a Cuban delegation, came to Europe to endeavour to establish an agreement between the principal world market exporters with the object of stabilising sugar prices. Following preliminary discussions, the conference opened on December 9, 1930, and the agreement, since known as the Chadbourne Agreement, was signed in Brussels on May 9, 1931, by Cuba, Java, Czechoslovakia, Germany, Poland, Hungary and Belgium. Peru and Jugoslavia were later admitted into the scheme. The duration of the agreement was five years. Cuba agreed to segregate about 1,300,000 tons of her surplus and Java just over 700,000 tons, both countries agreeing to export not more than one-fifth annually during the scheme. Export quotas were established to allow of a gradual reduction of surplus stocks. Quotas provided for a broadening world market outlet, whilst provision was made for increases in quotas at certain advances in open market prices.

The plan resulted in the unwieldy stocks being liquidated in an orderly manner whilst production in participating countries was brought more into line with world outlets. Stocks held by participants, which at the end of the first quota year were over 4.8 million tons and rose to over 5.3 million tons a year later, were reduced at the beginning of the last quota year (September 1934) to under 2.8 million tons. Over the same period production in these countries was reduced by about 5 million tons.

Scheme failure

Prices failed to respond, however, and in this respect the scheme was a failure. We print below the average prices of raw sugar c.i.f. U.K./Continent from 1929 to 1936.

	s.	d.	
1929	9	0½	per cwt.
1930	6	7	,, ,,
1931	6	3¾	,, ,,
1932	5	9½	,, ,,
1933	5	3	,, ,,
1934	*4	8¾	,, ,,
1935	4	8	,, ,,
1936	4	8	,, ,,

*Record low 3s. 10½d.

In all fairness it must be mentioned that the plan was born at the commencement of the world economic blizzard when consumption increases could hardly be expected. Moreover, encouraged by war conditions and the wildly high levels immediately after the 1914-18 war as well as by sheer economic necessity, the trend towards economic nationalism had brought a considerable contraction of the world open market which continued throughout the life of the agreement and reduced the total outlet to little more than 3 million tons. India, of course, is the classic example of this trend. In 1930, India produced about 110,000 tons white sugar, but by the end of the Chadbourne Plan a total of nearly 1 million tons had been reached. The total has since approached 1¼ million. With Java as India's main supplier it is not difficult to visualise what this meant to that island's economy nor to realise what repercussions this had on the open market position generally.

There were other causes of its failure, not the least of which was the fact that whilst it embraced most of the important world exporting producers it had no control over others, and under the 'umbrella' of the Chadbourne Plan several non-signatory countries increased their production and exports. The optimism which characterised the estimates of the world open market outlet was also a factor in the failure of the plan.

The 1937 Agreement

At the conclusion of the plan the International Sugar Council, which was its executive organisation, was maintained and has since administered the international agreement of 1937.

War clouds were so soon to darken the international horizon that it is impossible to know how effective this agreement would eventually have been under normal conditions. Suffice it to say that the promise of price betterment, which the trend during 1937 gave, failed to hold in the following year, the average in 1938 at 5s. 5d. per cwt. c.i.f. being 11¼d. lower. With the worsening of international political tension values assumed a hardening tendency in 1939, and at the outbreak of war in September raws stood at 7s. per cwt. c.i.f. Europe.

The world was then no longer dependent upon European beet sugar, for there were ample cane supplies to meet war-time requirements. Some even spoke of surpluses in the early days of the war, but those in the trade with memories of sugar conditions in the previous war preferred to regard these stocks as 'reserves.' This attitude to the world stock position was later found to be fully justified for, despite the fact that shortage of shipping reduced outlets, supplies to Allied territories had to be allocated by a central body. Devastation in Formosa and Java and general war conditions in Europe had a disastrous effect on production and the world had to rely more and more on Western Hemisphere sugar. Formosa, which reached a record of about 1,400,000 tons in 1938-39, dropped to less than 5% of that figure, whilst the 'statistical' production in Java went to a mere 8,000 tons. Progress in the latter island has been slow, but recovery is taking place, with the prospect of more than token exports this year. In Formosa, rehabilitation has been more rapid and she has recently been an important factor in the world market picture.

The very considerable progress which has been made by the producing countries of the British Commonwealth has been an outstanding feature of post-war sugar history, output today being about 50% higher as compared with the total at the end of the war. Production had naturally suffered during the war period as a result of the all-out war effort of the Commonwealth countries. That output was maintained as it was is a standing tribute to these producers.

Shortage of shipping space and other war conditions reduced demands and made it necessary for Cuba to restrict her crops during the war. She had, in any case, a carry-over stock at the end of 1940 of nearly 1¼ million tons. Production opened out as soon as freer movement to overseas markets was possible after the end of hostilities, and she has been able to dispose of crops in excess of 5 million tons.

The possibility of crop restriction in the future created the incentive for producers to grind as much cane as they could last year in order to establish generous individual quotas and this, added to very favourable climatic conditions, resulted in a crop of over 7 million tons. Such a crop was, of course, quite beyond the capacity of the market and the resultant surplus, which, but for the block purchase of 1 million tons by the British Government, would have been added to this year despite Cuba's restrictive measures this season, has impressed most people of the need for some control of open market supplies in the future.

Prospects of progress

It would be somewhat premature to hazard any opinion as to the outcome of the discussions which have been taking place. Agreement between nations with widely differing interests has never been a simple matter, but today there are many more intricate considerations which will tend to complicate the issue, not the least of which will be the currency aspect of the world sugar situation. If the negotiations do no more than provide a clearer outline of the difficulties with which the sugar world is confronted and lay a foundation for their eventual solution, they will be well worthwhile. Thus, perhaps, will the way be paved for the future understanding which is the objective of the world sugar industry as a whole.

Fernhurst Machinery Demonstration Centre

A new machinery demonstration centre, which was open to visitors recently for the first time, permits an extension of the work of the machinery department of Plant Protection's Fernhurst Research Station. The centre is designed to provide added facilities for the farmers, growers, spraying contractors, seed merchants and others who visit Fernhurst to study chemical methods of plant protection. The machinery department has long been prominent in pioneering methods of mechanical application of agricultural and horticultural weedkillers, insecticides and fungicides. Research at Fernhurst has led to the construction by British manufacturers of the 'Agro' and 'Plantector' low-volume sprayers and the 'Agrosan' seed dressing machine.

South African Crop Prospects

OUR South African correspondent has sent us the following information on agricultural developments in the Union of South Africa.

Double hybrid maize

For the first time in the Union a few thousand bags of double hybrid maize seed will be available to South African farmers—possibly for use in the 1953-54 growing season. Predicting that a double hybrid maize will eventually take the place of the common Bushman variety and will probably give an increased yield of from 25% to 30%, Dr. G. O. Grogan has been conducting experiments for more than a year at the Bethlehem Agricultural Research Station. A maize breeder from Missouri, U.S.A., Dr. Grogan was specially brought from America for these experiments. His plan is to grow maize resistant to the mealie borer.

Sugar prospects

An end to the sugar scarcity in the Union, the abolition of the quota or rationing system, and sufficient sugar for export to a profitable market is the aim of the South African sugar industry, Mr. W. G. Hammond, chairman of the South African Cane Growers' Association, stated recently in Durban, when he was addressing the annual meeting of the association. He said that for the first time in several years sugar carry-over at April 30 was enough to meet all consumer demands. First estimates for the coming sugar season indicated that the rationing of sugar in South Africa would come to an end. The weather in several sugar growing districts of Natal had recently been dry and the latest reports on the cane that was to be cut this season indicated that the prospects of a record output of sugar this year depended largely on the fall of good rains before the end of autumn. It was likely, however, that as a result of the favourable rains which fell during the summer an exceptionally large tonnage of cane would be ready for crushing this year.

Apricots, peaches, plums

Exports of apricots, nectarines, peaches and plums have been completed and the totals for the season, in each case except nectarines, showed satisfactory increases in comparison with shipments in recent years. In addition, the current figures for apples and pears are substantially larger than corresponding exports in past years, shipments of pears, at 1,020,900 cases of 40 lb. each, exceeding the million mark for the first time.

Citrus fruit

Citrus farmers and packing house workers up and down the fertile Sundays River valley have been busy picking and packing a crop which should bring in more than £1,000,000 by the end of October. One organisation alone—the Sundays River Citrus Co-operative—was packing fruit at the rate of 10,000 cases a day at its two packing sheds at Addo and Kirkwood. The packing house at Kirkwood has been extended at a cost of £60,000. This will enable it to double its output and increase the packing capacity by 15%. Although the present crop is described as only a good average one, citrus officials forecast that it will far exceed that of last year in both quantity and quality. An unofficial forecast of the total exportable crop from the valley puts the figure at 1,173,000 cases. This includes an estimated 400,000 cases of navel oranges, 475,000 cases of Valencias, 32,000 cases of mid-seasons and 250,000 cases of grapefruit. Citrus officials at Port Elizabeth expect to handle more than a million cases during the season.

Goldmine farm

About 18 months ago a syndicate of seven farmers bought the Holfontein gold mine, which had closed down, and began farming the 3,500-morgen property intensively. About 2,000 morgen—1,500 for maize, 200 morgen for potatoes, and the rest for beans and fodder—will come under cultivation this year. In the farm's first season last year 1,150 morgen was cultivated. There is little now to indicate the farm's past except a mine dump. Headgear and other mining equipment have been sold. A good tarred road runs through the farm, which is eight miles long and four miles wide, making management on this large scale a comparatively easy matter. The farm is mechanised. Water, a serious problem for the mine, is an asset to the farm, the seven boreholes giving a good supply.

Jointed cactus threat

The Minister of Agriculture is to call a conference in the Cape Eastern Province to intensify the battle against a deadly 'creeping menace'—the jointed cactus—which is threatening the land heritage of the Union. This was disclosed by the Secretary for Agriculture when he opened the Eastern Agricultural Union congress at East London recently. He said that the cactus—introduced into the country by an over-enthusiastic rockery plant collector—must be exterminated if South Africa was to be safe. In spite of all efforts by the State since 1934 to eradicate the cactus, the pest had spread and tightened its hold over wide areas. In the past 20 years the area under cactus had quadrupled. It had engulfed a million morgen of some of the best grazing land in the country. In the east it was nearly at Nahoon, while its western tentacles had reached Graaff-Reinet and Jansenville. It had crept up the Great Fish River to the north of Cradock and the valleys of the Sundays and Gamtoos Rivers, and even the headwaters of the Great Kei. Isolated patches had been reported in Natal and the Orange Free State. Re-infestation of cleared areas had almost kept up with eradication.

Biological control had failed and it was feared that mechanical control would also fail unless it could be done on such a scale as might strain the financial and labour resources of the Union. Laboratories throughout the world so far had not found a chemical to kill the cactus. The Minister said that the time had arrived for the public to be made aware of the devastating consequences to the country of this pernicious, noxious weed.

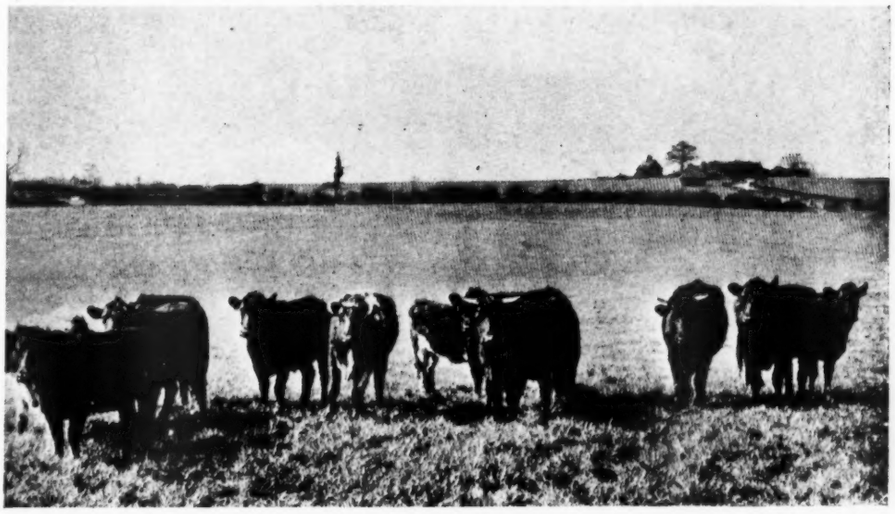
Grape production

This year the Hex River valley has, as usual, provided more than half of South Africa's export grapes. In its romantic history the valley has grown from six or seven mixed farms at the turn of the century to more than 200 specialised farms along its 20-mile length with an estimated annual turnover of £4,000,000 in grapes alone. The average farm is about 25 morgen and the cultivated area of the entire valley would just about make a respectable sheep farm in the Karoo. Prices for land are high—last year £2,000 a morgen was achieved—but not uneconomic, as the net income in a good season is as much as £8,000 on a 25-morgen farm. The cost of production of grapes in the valley is about 4s. 8d. for 10 lb., which is lower than most of the other well-known grape areas.

The past season might have been a record one but for heavy rainfall in April and early May, which caused the loss of about a fifth of the Barlinka crop through disease. The Barlinka grape, which first came from North Africa, is the backbone of the valley, but it is tending to overproduction. Farmers were having to take out some of their Barlinka vines and replant with late white varieties. This would iron out the unwanted peak in the export market and would help meet the big demand for white grapes.

Beef and Corn Production

A FARM demonstration was organised recently by the National Agricultural Advisory Service in conjunction with I.C.I. Ltd. at Mr. F. Appleyard's Chells Manor and Lodge Farms at Stevenage in Hertfordshore. The demonstration was held to show one system of farming which fits in well with national requirements in England. These requirements call for more meat for the people and more corn to feed the increasing numbers of livestock. The demonstration was attended by a large number of farmers from the county, and among the guests was Sir James Turner, president of the National Farmers' Union.



Grazing Italian rye grass ley at Chells Manor Farm

The farms

Chells Manor was taken over by Mr. Appleyard in September 1947, and the adjoining Stevenage Lodge Farm two years later. The two farms extend to 630 acres. The farm policy aims at the maximum production of beef from a relatively small acreage of grass and green crops, combined with a maximum production of coarse grains for sale off the farm. The grassland and leys are generously fertilised and heavily stocked to build up fertility for the following sequence of corn crops.

Much of the original permanent grass of the farms has been ploughed out, and the remaining permanent grass has been improved by manuring and management. New temporary leys have been put down. The aim has been to provide as long a grazing season as possible for the cattle, and thus reduce the period of hand feeding in yards to the minimum. Grass fields are in use more or less the year round. For the winter period reliance is placed upon kale and upon catch crops grown between successive crops of corn, these green crops being supplemented by feeding barley straw. The whole of the straw produced on the farm is baled and carted directly behind the combine for utilisation by the stock. There are two main methods of growing catch crops, either by undersowing Italian rye grass in spring corn, or by sowing out mixtures such as rape and rye after corn harvest.

TABLE 1

ACREAGE SUMMARY, 1953

Winter wheat	18.2	
Barley	359.0	
Arable silage	7.0	
Kale (including fodder beet)	37.1	
One-year ley (for grazing)	26.7	
Allotments	1.8	
Total arable		451.7
Long leys		68.6
Permanent grass		87.4
Roads, buildings and woods		22.6
Total acreage		630.3

TABLE 2

LIVESTOCK SUMMARY

	June 1950	*June* 1951	*June* 1952	*April* 1953
Nurse cows	13	10	13	10
Cattle over 2 years	80	128	60	105
Cattle between 1 2 years	73	81	148	162
Cattle under 1 year	40	95	140	125
	206	314	361	402

Management of grass

Ley fields are divided to allow of rotational grazing. All fields are topped with the Cutlift in July, the toppings being made into silage. This is an important feature of the management as it takes care of any patches of grass which may have become unpalatable as well as controlling the coarser species.

The permanent grass fields make a large contribution. They are grazed by groups of stock the year round, serving in winter as run-back fields for the older cattle grazing kale and catch crops, barley straw being fed out on these fields, or in very bad weather in yards. Grass surplus to grazing requirements is cut for silage and hay. A certain amount of arable silage is also made, the aim being to obtain a large bulk of medium protein silage suitable for the bigger cattle. A small quantity of meadow hay is made for the young calves.

Arable crops

Of the 451 acres of arable land this year, no less than 377 acres are corn, the remaining being kale, arable silage, one-year ley (for grazing) and a small acreage of fodder beet.

Stubble cleaning is carried out where possible, and use is made of selective weedkillers based on MCPA for the control of weeds in corn, application being by low-volume spraying equipment.

Stock

The livestock numbers of the farm have risen progressively each year, and on April 1 this year the figure had reached 402. All the bull calves are purchased from an attested Shorthorn herd of 200 cows in the north of England at a few days old, and in addition some colour-marked calves are obtained locally. They are reared on nurse cows in conjunction with milk substitute and weaned at three months, being finally sold off the farm at about 11 to 14 cwt. live weight.

Conclusion

The present success of the farm policy can be clearly seen from the fact that in the short space of six years, the farmer has increased his livestock figure from practically nothing to 402, while at the same time increasing the acreage for corn production. The demonstration can thus be said to be important in its implications as well as being most interesting.

Agricultural Machinery Exhibition

The 26th International Agricultural Machinery Exhibition (Salon International de la Machine Agricole) will be held in Paris at the Parc des Expositions, Porte de Versailles, from March 2 to 7, 1954.

FAO Wheat Conference

The second conference on Wheat and Barley Breeding in the Near East, convened by FAO in Cairo in April, was attended by delegates from Egypt, Iran, Iraq, Jordan, Lebanon, Pakistan, Syria, Turkey and Cyprus.

After considering the reports presented by delegates on the organisation and progress of wheat and barley breeding programmes in the participating countries, the conference reaffirmed its belief that by making the fullest possible use of available facilities and technical personnel, and exchanging information and breeding material through a comprehensive, well-balanced plan for regional co-operation, accelerated progress in the development and utilisation of improved varieties of wheat and barley in the region would be made. Such regional co-operation could best be achieved through the committee on wheat and barley breeding in the Near East, as recommended by the first conference in 1952.

During the conference the major breeding problems involved in wheat and barley production in the region were outlined, with emphasis on resistance to rusts, smuts and other diseases. It was agreed that co-operative uniform wheat and barley nurseries should proceed on essentially the same lines as in the past season. The total number of nurseries for wheat rusts, wheat bunt and barley to be established in the eight participating countries for the 1953-54 season will be over 80.

Identification of physiologic races of wheat rusts has been intensively carried out for several years in the rust laboratory of the Egyptian Ministry of Agriculture in Dokki, Cairo, which has generously offered to identify collections of rusts from other countries in the Near East. Turkey has recently also initiated such studies.

The conference considered that more adequate facilities for pathological investigations are needed in the region and expressed the hope that the Governments of Egypt and Turkey would explore all possibilities of improving their laboratory and greenhouse facilities for such work as soon as possible. It was reported that facilities for pathological investigations are also being established in Pakistan. Rust research laboratories in these three countries, each being located in a different section of the Near East, will, when properly staffed, serve the immediate needs of the region. However, it was recognised that as breeding programmes develop further in the other countries it may be desirable to establish rust laboratories to serve them.

The gardens of the cottages

Land Reclamation in England

IN these days when the efficient use of land in Great Britain is becoming more and more important, increasing interest attaches to the reclamation for agricultural production of small and often unconsidered areas of land which have for one cause or another been allowed to run to waste. The attached illustration shows the gardens of a row of cottages on the estate in Hampshire of Mr. W. Leonard Hill, Chairman of Leonard Hill Ltd., the publishers of WORLD CROPS. When these cottages were built it was the custom to provide large gardens for the occupants. In fact in the old days the applicant for employment in an agricultural area always made a point of the size of his garden. At that time a very pertinent point, for indeed he kept his pig, maybe a couple of goats or even a cow, and grew the great majority of the food for his family. Nowadays the gardens are largely neglected and untended.

One row of five cottages and another of three permitted the reclamation of no less than 2½ acres without in any way robbing the existing tenants, using nothing more than a Ferguson tractor, Horndraulic loader, a winch and hand labour.

It should not be difficult to discover many similar fruitful acres which could be reclaimed to food production in a similar fashion and it might very well total half-a-million acres. The advantages to be gained are more than are at first apparent. On the lands in question kale has been planted as the first crop but it is intended at a later stage to utilise it partly for the rearing of calves.

Revised Marginal Production Scheme

The English Ministry of Agriculture and Fisheries, in agreement with the National Farmers' Union, has announced the ways in which it is proposed to employ in England and Wales the extra funds (amounting to £1¼ millions) allocated at the 1953 Farm Price Review for additional assistance under marginal production schemes.

More feeding stuffs

In the first place, a substantial proportion of the money will be used to enable small livestock farmers to grow more of their own feeding stuffs by making greater use of the existing provisions of the marginal production scheme for grants towards the cost of improvements, such as the application of lime and fertilisers, reseeding of pastures, and the regeneration of grazings and the reclamation of scrub and derelict woodland. Secondly, the scope of the scheme will be extended to include various improvements which have previously been ruled out or have been subject to limitation.

Means test

It is also proposed to modify the so-called 'means test' where improvements which call for expenditure on a scale not justified by the immediate returns are undertaken. These improvements include fencing, drainage and ditching, claying and marling, as well as the reclamation of scrub, derelict woodland and unproductive orchards.

The revised scheme will be administered by the County Agricultural Executive Committees, to whom proposals for carrying out improvements should be sent.

Jealott's Hill's Silver Jubilee

The celebrations held on July 15 to mark the 25th anniversary of the foundation of this well known and justly celebrated research station, were attended by upwards of 260 guests. Among those present were the Minister of Agriculture, The Rt. Hon. Sir Thomas Dugdale, Bt., Lord Waverley, Lord McGowan, Mr. G. R. H. Nugent, M.P., and a large number of leading agricultural scientists, including Sir John Russell, Sir Frank Engledow, Sir William Ogg, Sir J. Scott Watson, Sir Geoffrey Clay, Sir Edward Salisbury, Sir William Slater and many others, together with representatives of all sections of the Press.

The guests were entertained at luncheon in a large marquee, the chairman of I.C.I., Dr. Alexander Fleck, presiding. The toast of 'Agriculture' was proposed by Mr. S. W. Cheveley, O.B.E., chairman of the Central Agricultural Control of I.C.I., who in the course of his speech touched on the history of Jealott's Hill and the part scientific research plays in the changing aspect of agriculture in Great Britain. In his reply, Sir Thomas Dugdale referred to the great and responsible task that was the lot of the Ministry of Agriculture and the collaboration it received from industry, paying tribute to the contribution made by science in this connection.

Subsequently in short speeches previous directors of Jeallott's Hill, Mr. H. J. Page, C.M.G., and Prof. Stephen Watson, as well as Prof. G. H. Blackman and Lt.-Col. W. R. Peel, D.S.O., with the present director, Dr. A. H. Lewis, commented on the work carried out there and the manner in which it had developed and expanded over the years.

After lunch, the guests divided into parties and were afforded the opportunity of making short tours of the laboratories at Jealott's Hill and Hawthorndale and gaining a slight insight into some of the many lines of work in progress.

(*Top*) **The main building, Jealott's Hill** (*Centre, left to right*) **Sir Alan Hitchman, Dr. A. H. Lewis, Sir Reginald Franklin, Mr. S. W. Cheveley, Dr. Alexander Fleck and Sir Thomas Dugdale at Jealott's Hill** (*Bottom*) **A group of visitors with Dr. W. G. Templeman in the pot culture shed at Jealott's Hill**

Book Review

Science and Fruit

By T. Wallace, C.B.E., F.R.S. and R. W. Marsh, M.A. Commemorating the Jubilee of Long Ashton Research Station. Pp. xiii + 308. 1953. The University of Bristol. 30s. ($4.50) nett.

This book has been prepared and issued by the University of Bristol to commemorate the Jubilee of the foundation of the Long Ashton Research Station. It contains a brief foreword by the Chancellor of Bristol University, the Rt. Hon. Sir Winston Churchill, with a preface by Captain D. M. Wills, C.B.E., Chairman of the Agricultural Committee of Bristol University and of the Governors of Long Ashton Station, after which the Jubilee memorial address of Lord Rothschild, chairman of the Agricultural Research Council, is reproduced. Then follows a brief history of the origin and development of Long Ashton by Prof. T. Wallace, the present director and Mr. B. T. P. Barker, the first director of the Institution.

The remainder of the book is occupied by a series of papers by members of the staff of Long Ashton, in which are summarised some of the principal results achieved during the period of the station's existence in the various lines of research activity undertaken, each being an up to date account of the position.

Examples of these are the articles on Plant Hormone Research by Dr. Luckwill and on Fruit Budformation by Dr. Luckwill and Mr. Swarbrick, on the Mineral Nutrition of Fungi by Dr. D. J. D. Nicholas, on Fifty Years of Insecticides and Fungicides in Fruit Culture by Dr. J. T. Martin, on Sand Culture Methods in Plant Nutrition Investigations by Dr. E. J. Hewitt and the Effect of Orchard Factors on the Quality and Storage Properties of Apples by Professor Wallace himself.

The book itself therefore happily combines the role of being an appropriate memorial of an important occasion in the history of Bristol University and of Long Ashton Station with that of serving as a valuable work of reference on the present position of various lines of research in fruit and vegetable production which Long Ashton itself has done so much to advance and improve.

H.T.

Insecticidal Aerosols

The short article with the title Insecticidal Aerosols in Flour Mill Premises which appeared on page 332 of our August issue was written by Mr. T. W. Barker, B.Sc.

Guests at the demonstration inspecting examples of cereal crops

A Farm Demonstration

An important demonstration and conference was recently held on the farm of Mr. John Rowsell, J.P., at Stoke Charity, near Winchester in Hampshire. It was organised by Imperial Chemical Industries Ltd. in conjunction with Wilts, Hants and Dorset Seed Growers Ltd.

The gathering was mainly concerned with showing how farming in Britain can be diversified and extended. Originally, when the farm was first taken over by Mr. Rowsell, it was approximately 700 acres in area and was almost exclusively devoted to mechanised corn growing. Since then a pedigree herd of Wessex saddlebacks has been established, the growing of grass and clover for seed production has been introduced, the farmed area has been extended by some 400 acres by the reclamation of adjoining waste land formerly used for military purposes, a flock of Clun Forest sheep has been established and poultry rearing on a large scale inaugurated. As a result of a visit to New Zealand on the part of the owner under a Nuffield scholarship, the whole farm has been fenced for all classes of stock and main water piped to all principal fields. Of the total area of 1,100 acres farmed, about 1,000 acres each year are devoted to cash crops, including about 620 acres of cereals, 300 acres of grass and clover leys for seed, 50 acres of lint and mustard for seed and 30 acres of sugar and fodder beet. Comprehensive programmes of fertiliser applications and spraying are carried out. The farm is well provided with buildings and the equipment includes a battery of concrete silos.

The demonstration was attended by some 700 farmers, who visited most of the fields, and was followed by a conference at Worthy Down Aerodrome presided over by Mr. Roland Dudley, who himself farms a large area in the same district, speakers at which included Mr. F. R. Horne, M.A., Director of the National Institute of Agricultural Botany, Mr. R. A. Hamilton, of Imperial Chemical Industries, and Mr. John Rowsell himself. The whole subject was summarised and the discussions reviewed by Sir James Scott Watson, Chief Agricultural Adviser to the English Ministry of Agriculture.

B.A.M.M.E.X. Amalgamation

The British Agricultural Machinery Manufacturers Export Association has now amalgamated with the Agricultural Engineers Association in order to secure unity of policy within the industry. This amalgamation, while strengthening the Export Association ensures continuity of the services which B.A.M.M.E.X. provides to overseas buyers. Enquiries in future should be addressed to the A.E.A. (Export), 222 Dashwood House, 69 Old Broad Street, London, E.C.2, England.

British National Weed Control Conference

A National Weed Control Conference, at which the latest developments in the field of weed control will be reviewed, will be held on November 3, 4 and 5, 1953, at the St. George's and Norfolk Hotels, Cliftonville, Margate. The conference president will be Prof. Sir James Scott Watson, chief scientific and agricultural adviser to the Ministry of Agriculture and Fisheries. The conference will be residential. Provisional programmes and application forms may be obtained from the Conference Treasurer, Mr. W. A. Williams, Association of British Insecticide Manufacturers, 166 Piccadilly, London, W.1.

Reports and Publications

The Report of the Administrative Council of the Empire Cotton Growing Corporation for the year ending March 31, 1953.

The report of the Council of the Empire Cotton Growing Corporation constitutes once more a revealing account of much valuable work. Founded in 1920 with the object of assisting cotton production in the British Commonwealth by promoting research, the Corporation can claim to have achieved abundant success inasmuch as during the 33 years of existence cotton production in the Commonwealth has increased nearly tenfold from 112,000 bales of 400 lb. in 1921 to over 1,000,000 bales in 1950 and a little under this figure in 1951-52.

The present report divides itself into sections, one of which is concerned with general progress and the details of research accomplished, while the other contains a summarised account of the work done and the progress made in the different countries in which its activities have occurred.

This latter section is of such general interest that we have reproduced it in another part of this issue.

One section deals with progress at the corporation's research station at Namulonge in Uganda, where a total of 268 acres was under cultivation. It is felt the present standard rotation adopted on the station may be doubtfully uneconomic. It comprises three years under arable cultivation, followed by three years under grass. Other rotations are planned for comparison, including six years arable followed by three years grass, and arable continued for as long as possible.

In lint physiology, soil studies and other directions advances are reported, while in many other directions progress is recorded. It is obvious that the work of the corporation continues to grow in scope and value.

The British National Institute of Agricultural Botany Annual Report for 1952.

The Council of the N.I.A.B. has recently published its 33rd annual report covering the year 1952. The report refers to the improved staffing establishment, which should result in earlier analysis of trials and results and preparation of reports for publication.

It has been possible to arrange for an increase in the number of regional trials centres by starting in 1953 an additional centre at the N.A.A.S. Experimental Husbandry Farm at Trawscoed, near Aberystwyth. The total number of centres is thus brought up to 13, covering all parts of the country.

Reference is also made to the arrangements made for the institute to test at an early stage material produced by the plant breeding stations at Edinburgh, Aberystwyth and Cambridge. These trials will give workers at the breeding stations an opportunity of having selections tested in a different climatic region from their own before they are included in trials on a national scale later.

The institute has become the registration centre for England and Wales for herbage strains bred in this country or introduced from abroad.

The annual report also includes detailed comments on different varieties included in trials during 1952.

It is obvious that the work of the institute is continuing to grow both in utility and importance.

The Colonial Territories, 1952-3. Pp. 158. London, 1953. Her Majesty's Stationery Office. Price 5s. net.

The report of H.M. Colonial Office for 1952-53 is between 80,000 and 90,000 words long and few of them are wasted. New developments or marked changes in older ones are often dealt with in a few lines and the reader must be wary not to miss them. Thus only a handful of words deal with the setting-up of a new company to carry out further experiments in jute cultivation in British Guiana. First trials of jute growing there have been satisfactory and joint finance has been provided by the British Government and Dundee's jute industry. Although as a whole colonial cotton output is little above its pre-war average, Nigerian annual production has risen by at least 40% as the cumulative result of measures taken over a number of years by the Nigerian Cotton Marketing Board to stimulate production.

A general development throughout most colonial territories is the setting-up of new industrial factories, many of them being small private ventures operating locally; food canning is one of the principal activities pursued. Here, perhaps, are the beginnings of a most significant change in colonial crop economics.

The demand for East Africa's pyrethrum remains firm, a notable achievement in view of the numerous synthetic insecticides that are now available, not least of all the synthetic near-relative of pyrethrins, allethrin. A few years ago prospects for pyrethrum seemed much more dubious. Colonial sugar production is still increasing, with record crops in Mauritius, British Guiana and St. Kitts. Perhaps the worst case of agricultural adversity is that of Zanzibar, where an exceptionally bad winter in 1952 reduced the clove crop to something under 4,000 tons. In the previous year the crop had been only 5,243 tons, as compared with the 1950-51 figure of 19,480 tons. Effective control measures of a simple kind have been found for the die-back disease in clove trees, and after six years the clove research scheme has been able to close down. Bad weather has struck harder than pestilent fungi. It is to be hoped that Zanzibar's clove production will recover as remarkably as Jamaica's banana production, which by the end of 1952, despite the hurricane of 1951, enabled bigger shipments to be made than at any time since the war.

D.P.H.

FAO Advisory Assistance to Member Countries under the UNRRA-Transfer Fund (FAO Development Paper)

This paper is intended primarily for agricultural administrators and technical workers in under-developed countries. It deals not with specific technical subjects, but with the kind of advisory assistance given to member government and the methods used. It gives some idea of the work already carried out and an evaluation of the methods adopted. It is of special interest to all concerned with agricultural administration.

FAO Yearbook of Fisheries Statistics, 1950-51

This is the third yearbook to be prepared by the FAO Fisheries Division. It continues, revises and expands the statistics which were published in the two earlier issues. The present volume contains 296 pages.

Technical News

In the September issue of *Food Manufacture* James Devey discusses 'The Theory and Practice of Gas Packaging of Foodstuffs'.

Building Digest for September will feature the second part of the article by Gordon Joseph on 'Rebuilding Western Germany'.

Chemical and Process Engineering for September includes 'Ion Exchange,' by J. M. Hutcheon, B.Sc.; 'Vacuum Technique,' by S. L. Martin, M.Sc., F.R.I.C.; and 'Batch versus Continuous Distillation —2,' by S. R. M. Ellis, Ph.D., F.R.I.C., A.M.I.Chem.E., and J. T. Shelton, B.Sc.

In the September issue of *Manufacturing Chemist* there is an article on 'Particle Sizes for Additives to Animal Foods,' by C. Bloom, B.Sc., and E. F. Livesey.

FARM MACHINERY

Caterpillar Tool Bar

A new hinge-type No. 42 Tool Bar is now offered for use with D4 and D2 tractors by the Caterpillar Tractor Co. The new arrangement is stated to permit swinging draft members to operate the tool bar at the front or the rear of the tractor. The change may be made in a matter of minutes and permits a greater variety of attachments for the farm user. Tools are available for cultivating, listing, subsoiling, furrowing, chiseling, disc ridging, border building and other jobs.

The Caterpillar D2-No. 42 Tool Bar Agricultural Blade has been re-designed to accommodate installation with the new draft frame members. This is said to increase the usefulness of the D2 by enabling the farm user to accomplish land clearing, levelling, farm pond construction, snow removal and general bulldozing. A blade for the D4 tractor is among the new attachments being planned.

Manure Spreader

A farm machine which can be used both as a manure spreader and a forage wagon is now being built by New Holland Machine Co. The new double-duty machine is a good example of the efforts of manufacturers to give farmers equipment to handle more than one job.

As a spreader, the machine can take care of up to 130 bushels. With extension sides and rear gate, the machine becomes a forage box to carry up to 3 tons of chopped forage. Equipped with power take-off, the machine is self-unloading when used as a forage box. A moving apron takes the chopped forage to the rear of the box and then beaters evenly distribute it right in the forage blower for filling silos.

Hay Rake

High-speed raking in the heaviest hay is now said to be possible with the new McCormick International No. 5 side-delivery rake, which has a greater capacity than any rake ever produced by International Harvester. Equipped with a heavy twin-beam frame to permit faster speeds, the No. 5 is claimed to provide gentle raking action of an 8-ft. swath to produce straight, uniform windrows without weaving. The ground-driven reel automatically adjusts to the tractor ground speed and prevents hay churning, roping or tangling, at the same time cutting down leaf loss. Twin caster wheels guide the reel over rough terrain and irrigation borders to reduce tooth breakage.

Open coil spring teeth are mounted on the forward side of the reel bars to enable the rake teeth to stay in contact with the hay longer for extra capacity. Keeper springs keep broken teeth from falling into the crop. Two conveniently located levers can raise the four-bar reel, floated in the reel basket, up to 6 in. Any 15-in. automotive tyre can be placed on the low, disc-type drive wheels. Power from the drive wheels to the reel is transmitted by means of a gear and chain drive. Rake teeth, set by a crank adjustment from angles of 40 degrees forward to 35 degrees behind the vertical position, are kept in position by a spider wheel mounted on the ball bearings. These bearings assure the running reel of less vibration and wear.

This new hay rake is said to rake a full 8-ft. swath

The Down-the-Row thinning machine is to be used for thinning sugar beet and similar beet crops

Beet Thinning Machine

Kenneth Hudson and Son recently exhibited a prototype of the Hudson Down-the-Row Thinning Machine for thinning sugar beet and similar root crops. The machine can be mounted on the hydraulic linkage and models will be available to suit all makes of tractor with a normal three-point method of attachment. Each thinning head has provision to take 16 blades.

The first operation is to cut out 50% of the crop by using only eight blades. In one revolution of the eight-blade thinning head the machine moves forward 28 in., making eight thinning strokes $1\frac{3}{4}$ in. wide. 8 by $1\frac{3}{4}$ in. equals 14, which is half of 28 in. Thus half the beet and half the weeds are eliminated.

Further thinning is done without the necessity of synchronisation by using 16 blades which will cut out $\frac{15}{16}$ in. or thereabouts. A further set of 16 blades is available to cut out approximately $\frac{11}{16}$ in. By using these three sets of blades at various settings the crop can be reduced to contain 10 seedling inches per 100 inches over a wide range of braird.

WORLD CROP REPORTS

INDIA

Wheat crop. The all-India fourth official wheat estimate places the 1952-53 crop at 6,388,000 tons from 23,082,000 acres. This compares with the corresponding adjusted estimate for 1951-52 of 5,700,000 tons from 22,874,000 acres.

The increase in production is shared by nearly all the wheat growing states and is due to the better climatic conditions during the current year.

CHINA

Crop prospects. Almost 90% of the rice fields have been affected by drought in Communist China. Corn and potato plants have died and the drought is likely to seriously affect autumn crops.

MEXICO

Wheat and maize. The wheat harvest in Mexico has been estimated at about 18.5 million bushels, a million bushels above the 1952 crop. A crop that size would be above average although not up to the high level of 1950 when an estimated 20.2 million bushels were harvested.

The outlook for the important maize crop is said to have been good. The acreage was expected to be about the same as in 1952 but the harvest should be somewhat above that of a year ago since a much greater availability of hybrid seed and fertilisers are reported. Also increased irrigation is expected to follow better credit facilities and technical supervision. The main crop was planted under favourable conditions and, in general, prospects for a good maize crop were better than average.

ITALY

Vegetable seed oil. Italy may need to import 45,000 to 55,000 short tons of vegetable seed oil or the equivalent in oilseeds to cover its vegetable oil requirements through October of this year of around 395,000 tons and still allow for at least 55,000 tons of Government seed oil stocks.

The final official estimate of olive oil production from the 1952 olive crop is 202,000 tons or about one-half below the previous year's record output, but roughly 35,000 tons larger than pre-harvest indications. Unofficially, it is believed that production must have been around 220,000 tons. With the addition of the expected 28,000 tons of sulphur oil, olive oil production would total 230,000 tons.

During 1952, Italian edible fats and oils availability reached an all-time high due to the production of 389,000 tons of olive oil plus some 45,000 tons of sulphur oil and increased hog slaughter. Edible seed oil production is estimated at 37,270 tons; adding imports of 27,300 tons, total edible seed oil supplies were 64,570 tons compared with 101,220 tons in 1951. On the other hand, inedible seed oil production plus imports totalled 81,700 tons against 79,315 in 1951.

Italian oilseed production in 1951 and 1952 was estimated officially as follows in short tons:

	1951	1952
Peanuts	8,170	9,170
Sunflower	6,560	6,145
Sesame	460	410
Soya beans	1,020	1,540
Castor beans	700	620
Hempseed	3,640	3,575
Flaxseed	13,280	12,670
Cottonseed	10,020	10,860

AUSTRIA

Grain prospects. A very good, possibly even a post-war record, grain crop was expected in Austria in July. Wheat, rye and winter barley crops were said to be in excellent condition.

BRAZIL

Oiticica production. The 1953 oiticica harvest in the State of Ceara, Brazil, is estimated at 18,700 short tons. This compares with an average crop of 27,500 tons. Ceara is the major oiticica-producing state in Brazil, accounting for nearly one-half of the total output. Oiticica oil is obtained from the fruit of *Licannia rigida*. It is used as a drying oil in paints.

U.S.S.R.

Spring grains. The seeding of small spring grains (wheat, barley and oats) had been completed by mid-April in a number of southern regions in the Soviet Union. It was officially reported that by April 15 the acreage seeded to all crops in the Soviet Union was 8 million acres larger than that seeded on the corresponding date last year.

In a number of regions, however, sowings lagged. In general, weather conditions during the current season appeared to be unfavourable to field work, as was also the case in the spring of last year. Another adverse factor was the large area that had to be ploughed because of the non-fulfilment of the goal for ploughing last autumn of an area that was to be used for seeding this spring.

Slow progress in planting of forage and other non-grain crops, such as sunflower seed and cotton, was reported. Soil moisture had been generally satisfactory or abundant, which must be regarded as a favourable factor in the crop outlook, especially since a considerable part of Russian agricultural area is in the semi-arid zone and subject to frequently recurrent devastating droughts.

ARGENTINA

1953-54 wheat crop. The drive for the sowing of an increased area to wheat in Argentina has been interpreted by local observers as official recognition that last year's bumper crop of 7,800,000 tons was largely the result of good weather. It is felt that if the same area was sown this year and the weather was only slightly less favourable than last year, then the 1953-54 wheat crop could well fall short of essential national economic needs. Meanwhile, the Governor of Buenos Aires Province has reported that wheat sowings in that province were approximately 3,200,000 hectares. If that is a final figure, say observers, it marks an increase on last year's area of some 175,000 hectares or 5.8%, reflecting the drive for increased acreage.

BELGIUM

Grain crops.—The area sown to wheat in Belgium this year is 3.5% greater than last year's 162,380 hectares, according to the results of an agricultural census taken on May 15. There was also a notable increase in the area sown to winter barley and a smaller one in rye, while the areas planted to barley and oats declined. The following table shows the percentage changes officially estimated as compared with 1952:

	May 15, 1952	Difference May 15, 1953
Wheat	162,380	+ 3.5%
Rye	76,860	+ 1.6%
Winter barley ..	29,500	+ 5.6%
Barley ..	59,000	—2.0%
Oats	162,239	—2.6%

WORLD

Rice production.—World rice production in 1952-53 (August-July) is said to have been the largest on record. The total rough rice crop is estimated at 354,100 million lb., 4% larger than the previous post-war record of 342,000 million lb. in 1948-49, and 5% more than the 337,700 million lb. of 1951-52. The 1948-49 production was about the same size as the largest world harvests before the war. In terms of milled rice (rough rice converted to terms of milled at 70%), world production in 1952-53 is estimated at 124

million short tons compared with 120 million tons in 1948-49 and 118 million tons in 1951-52.

Rice acreage was increased wherever this season's weather permitted throughout the areas of the world in which soils and climate are adaptable to the cultivation of the cereal. Moreover, weather in 1952-53 was favourable in many countries in contrast with the previous two years when adverse weather restricted output.

By continent, the largest crop increases are in Asia, where 92% of the world's 1952-53 rice output was and is being harvested. Excluding China, that continent's total outturn is estimated at 222,000 million lb. of rough rice (78 million short tons milled), a gain of 5% or 2.1 million tons milled over the preceding year. The principal increases in order of volume are noted in India, Japan, Pakistan, Burma, Indonesia, South Korea, the Phillipines, Malaya and Taiwan. Only in Thailand and Ceylon are crops smaller than those of a year earlier.

The total production in Asia's three major exporting countries, Burma, Thailand and Indo-China, is estimated at 40,000 million lb. of rough rice (14 million tons milled), or about the same as in 1951-52. The increase in the production of Burma was offset by a decline in Thailand and Indo-China's crop is believed to be about the same as a year earlier.

In Europe, production increased again in all countries where rice is grown, with the exception of Portugal. That continent's total production in 1952 of 3,700 million lb. of rough rice (1.3 million tons milled) compares with 3,300 million lb. (1.2 million tons) in the preceding year, and an average of 2,400 million lb. (800,000 tons) before the war Italy, France, Greece and Spain again harvested the largest crops on record. Portugal planted a record acreage in rice, but unfavourable weather reduced the production below that of last year.

The total harvest of the Western Hemisphere is estimated at 15,700 million lb. of rough rice (5.5 million tons milled), which is 4% of the 1952-53 world crop. Rice acreage planted in both North America and South America shows a further expansion from the acreage of a year earlier, the rice areas there having increased steadily since the early years of the war. These continents now are planting more than double the pre-war acreage in rice and are harvesting more than twice the volume prior to the war.

In North America, favourable weather in most of the countries resulted in increases in per-acre yields. The largest gain in production was in the United States, where the acreage increased only slightly and per-acre yields were the highest on record. The next largest increases in order of volume were in Cuba, Panama, the Dominican Republic, Costa Rica, Nicaragua and El Salvador. Lack of rainfall during the planting season reduced Mexico's acreage planted in rice and although larger yields were harvested than in the year before, production was smaller.

Rice acreages increased in all the countries of South America, with the exception of Peru, where floods at the time of planting prevented some land from being planted in rice. The total production of South America, however, is only slightly larger than last year, primarily because of a poor crop in Brazil. In several countries weather was beneficial for the production of good rice crops, particularly Ecuador, Columbia, Peru and Uruguay. In Brazil, however, which produces about two-thirds of South America's crop, dry weather in the north-eastern and central States reduced the yield per acre. Although Brazil's acreage was increased in 1952-53, the harvest is estimated at about the same as in 1951-52.

Drought in some areas of Africa reduced rice production below that of last year, although the rice acreage harvested in 1952-53 is believed to be about the same as a year earlier. Lack of water in Egypt during planting was responsible for a sharp drop in rice acreage, even below the reduced acreage of the preceding year. Per-acre yields in Egypt were below average and that country harvested the smallest rice crop since 1937.

Growing conditions were favourable for the production of a good crop in Australia, and rice acreage and production exceeded that of a year earlier but were not so large as in 1950-51.

Foreign Crops and Markets.

Cotton production. World cotton production in 1952-53, now estimated at 35,370,000 bales, is about a quarter of a million bales less than the crop of 1951-52. Of the world total, the United States is accounting for slightly over 15 million bales and foreign countries for a little more than 20 million. The slight downturn in the current season suggests a possible levelling-off of production after the long upswing from the 21.1 million bales of 1945-46, the low point to which it had fallen in the course of the war.

The 1952-53 pattern of production in the major cotton-producing regions of the world shows some variation from a year ago, although the changes are not generally very great. The major reduction is in South America where Brazil, notwithstanding its price supports above the competitive world level, is showing a decline of 450,000 bales. Although Peru and Argentina are at their all-time peaks, the small increases there and in Colombia are to some extent offset by reductions in Paraguay and Venezuela. Elsewhere in the Western Hemisphere changes are not significant. In the United States and Mexico better yields have offset smaller acreages and the crops are nearly identical in size with those of a year ago.

Small declines have apparently taken place in all of the African overseas cotton-growing territories of European metropolitan countries, although in British East Africa the decreases in Kenya and Uganda are apparently partially offset by gains in Tanganyika and Nyasaland. In French territories the changes are minor.

In the Indian Subcontinent an increase in the crop of Pakistan is attributed to a small increase in acreage and improved growing conditions while that of the Republic of India, though now revised upward by 100,000 bales, is down from a year ago by 250,000 bales, mainly because of drought.

Production in the countries of the Soviet Bloc is tentatively estimated on the basis of incomplete information at about 6.9 million bales, Communist China accounting for practically the whole of the 160,000-bale decrease from a year ago.

The region of greatest increase is the Middle East, where Egypt, the Anglo-Egyptian Sudan, Turkey and Syria each show a gain and together account for nearly 600,000 bales more than in 1951-52. Turkey attained a new peak of production. The recoveries in Egypt and the Sudan, the latter of which suffered a partial failure because of drought in 1951-52, are particularly marked.

Because of the gains in Egypt, the Sudan and Peru, as well as of the increased production of American-Egyptian varieties in the United States, the crop of Egyptian and Peruvian type staple cottons in the world is greater than that of a year ago by more than half a million bales. By contrast the reduction in the world crop of Asiatic types appears to be more than 300,000 bales and that of American-Upland types about 400,000 bales.

Early indications for 1953-54 are for no important increase in production and quite possibly some decrease. Acreage restrictions have been announced in Egypt, Syria and the Punjab State of Pakistan. Elsewhere, notably in Turkey, there has been some evidence of dissatisfaction with the returns from the current crop—a fact that may induce producers to shift to the alternatives of wheat, rice and tobacco.